AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 6, No. 10. WEEKLY. | NEW YORK, MARCH 10, 1883. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

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New Shops of the Holyoke Machine Co., at Worcester, Mass.

The first engraving on this page represents a rear view of the extensive shops recently erected by the Holyoke Machine Company, for the manufacture of the different sizes of the famous "Hercules" water wheel.

The main building is 154 feet long, fronting on the Worcester and Nashua railroad. The track in the foreground is owned and used by the concern above mentioned for shipping their products. The frontage on Thomas street, which runs to the left of the shop, is 113 feet. A general interior view of this shop, looking from the Thomas street entrance, is also shown, on this page, and on page 2 an interior view, taken from the opposite end of the lower floor of the main building. These, together with the general plans and elevations shown on pages 2 and 3, will make the whole intelligible to the reader.

A, *B*, *C*, (page 3) is the floor of the machine shop, the space *A* being used for the fitting up department. In this part are three traveling cranes, with pulley blocks attached, for the convenient handling of heavy pieces of work. The part *B*, is occupied by the various machines required for the different branches of machine work. These machines are composed of the following: *d* is a large boring mill, capable of swinging 13 feet, and which will bore a hole 12 feet in diameter, and *e* is a smaller boring mill, having a swing of 6′ 4″, capable of boring a hole 6 feet in diameter. This mill is shown in the reverse position of what it is actually placed in the shop. At *f* is shown a special drilling machine, and *g* is a special facing off machine, both designs of this concern, and built in their shops at Holyoke. At *h* and *i* are two 28-inch lathes, and at *j* a 30-inch lathe. At *k* is a slotting machine with 19-inch stroke, which will receive a piece of work 8 feet in diameter; *l* is a 16 inch hand lathe, and *m* a regular 18-inch engine lathe. At *c* is a 6-foot spliner or milling machine, designed particularly for cutting key ways in shafting, *b* is a 6 ft. radial drill, *Z* a 5-foot drill of the same class, and *a* is a 30-inch chucking machine.

There are two planing machines, *Y*, capable of admitting pieces of work 22″×22″×5 feet, while the one at *X* will take 26″×26″×6 feet. At *w* is a 90-inch lathe, with a bed 22 feet long, while the lathe to the left is a 60-inch swing with a bed of the same length as the former; *x*, *y* has 36-inch swing with a 32-foot bed; *z* has 18-inch swing with a 12-foot bed, while *&* has 18-inch swing with a 14-foot bed. *T* is a 30-inch drill press, *U* is a 20-inch hand lathe, and *V* and *W* are two 18-inch swing lathes with beds of 6 feet and 8 feet respectively.

It will be observed that the machines are all covered by cranes, the one at *P* having a 12 foot available radius, while *Q*, *R* and *S* have 16 feet each. It was the original intention to cover the space *C* by a traveling crane, but a jib crane of 18 feet radius has been substituted.

The space *C* is used for assembling and setting up the wheels when the parts have all been completed. When finished, these wheels are loaded upon a small car, which is pushed along the track *S* to the turn-table *t*, where it is turned in line with the track *u*, passing thence to the door, where the load is hoisted by a crane upon regular freight cars, and shipped to any part of the United States.

From this description the reader will readily comprehend how easily the material is handled, with little help and without waste of time.

The power to drive this shop is furnished by a Harris Corliss engine, having a cylinder 18″ in diameter, with a stroke of 42″, making 60 revolutions per minute. The engine-room and fly-wheel are shown at *F*. Power is transmitted to the main shaft, *L*, *L*, by means of a belt 24″ wide and 90 feet long. A single belt transmits power from the shaft *L* to *N*, *N*, upon the opposite side of the building.

The distance between centers of these shafts is 54 feet. The pulleys are 56″ in diameter, with 10-inch faces. The belt is 9″ wide and 121 feet long. There are two idler pulleys midway between the two shafts, which steady the belt so that there is scarcely a perceptible vibration.

Upon the second floor there are two lines of shafting, *M*, *M*, representing one, while the other is directly over *N*, *N*. This floor is now used as a pattern room and carpenters' shop, and contains the wood-working machinery. A portion of it is used as a store room for finished wheels kept in stock, but it will eventually be filled with small iron working tools, and the wood-working machinery removed to the third floor, which is now used for a lumber store room.

In the annex, *K* is a double row of closets with wash sinks upon three sides next to the walls. Each floor has these accommodations. At the top of this annex is a tank having a capacity of 3,000 gallons. Water is supplied by a power pump connected with a driven well, so that hydrant water is used only for feeding the boilers. A stand pipe passes down through the annex to the ground, supplying the closets and having a double coil of hose attached for each floor, to be used in case of fire. One feature of this building deserves especial consideration, that is the openings through the walls for the windows, instead of being square, are cut away at an angle of 60°, which admits a free light, whereas a square corner casts a shadow. This greatly adds to the lightness of the rooms, and is a decided improvement upon the finish of the building.

The walls of the first story are 24″ thick, the second story 20″, and the third story 16″. The height of the first story is 17 feet, of the second story 13 feet 6 inches, and of the third story 14 feet—all in the clear.

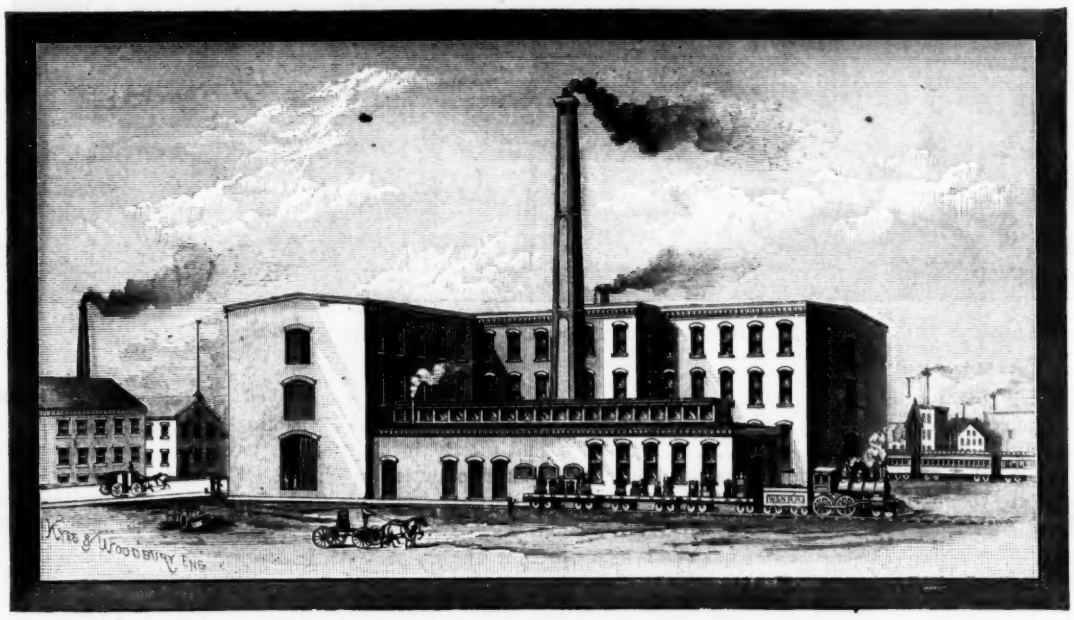
The wall at the left hand end of the building is only 16″ thick at the first story, and 12″ above, being intended for removal in case it becomes necessary to enlarge the building at any time. The entire length of the lot is 335 feet.

The steam to drive the engine and heat the buildings is supplied by three horizontal tubular boilers 5 feet in diameter, and 16 feet long, they being represented at *E*, *E*, *E*, in the engraving. Each of these boilers is rated at 75 H. P., which is far in excess of what is required at present, only one of the three boilers being used.

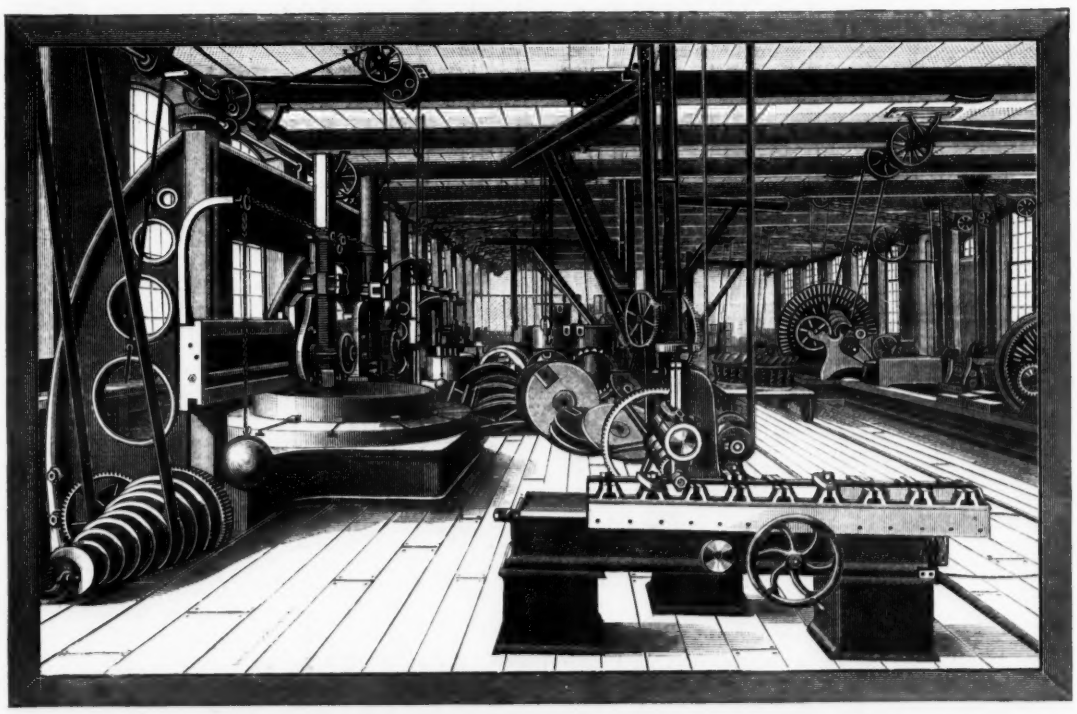
The entire building is heated by pipes suspended overhead.

The exhaust steam passes through a Berryman heater, thence through the pipes for heating the shop, escaping finally into the atmosphere, while the drip is conveyed to the sewer.

The chimney *G*, conveys away the products of combustion from the boilers, as well as the smoke and gas from the blacksmiths' shop, *D*. This chimney is of special de-



THE HOLYOKE MACHINE CO.'S NEW SHOPS AT WORCESTER.—REAR VIEW.



INTERIOR VIEW OF SHOP.—FIRST FLOOR LOOKING FROM STREET ENTRANCE.

sign, and will be described in a future issue. The exhaust fan *H'*, is for hastening the current of air, and forces the gases through the ventilating pipe *I*, to the flue *G*. The small blower *H*, is for furnishing a blast for the forges in the blacksmith's shop. Hoods placed over each forge connect with the ventilating pipe *J*.

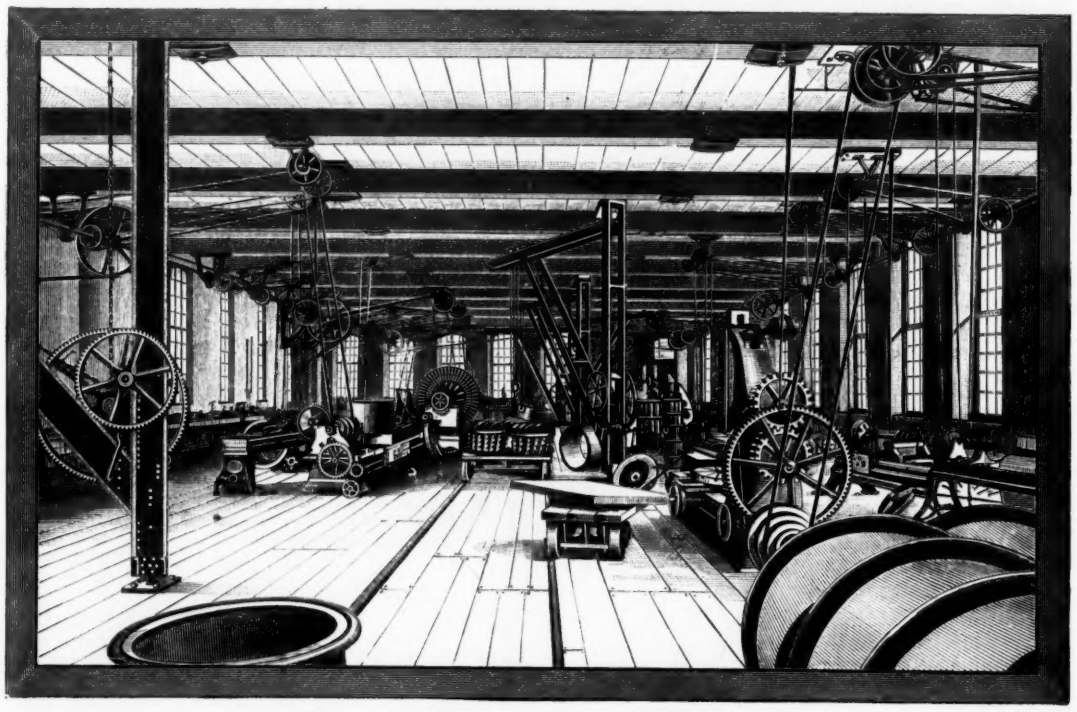
A line of shafting in the blacksmith's shop furnishes power for driving a power hammer, bolt cutter, and the blowers. The blacksmith's shop, boiler-house and coal-house are but one story high, as will be seen from the engraving, in which are given the principal dimensions.

The different lines of shafting can be instantly thrown in or out of gear by means of the friction clutches, *O*, *O*, shown in the plan of shop. In the upper right-hand corner *r*, of the engraving (page 3) is the tool room. In this room is a 13-inch hand lathe *o*, a 16-inch engine lathe *p*, a universal grinding machine *n*, and a universal milling machine *q*. The stock of tools in this room is very complete, being especially adapted to the particular class of work done in the shop.

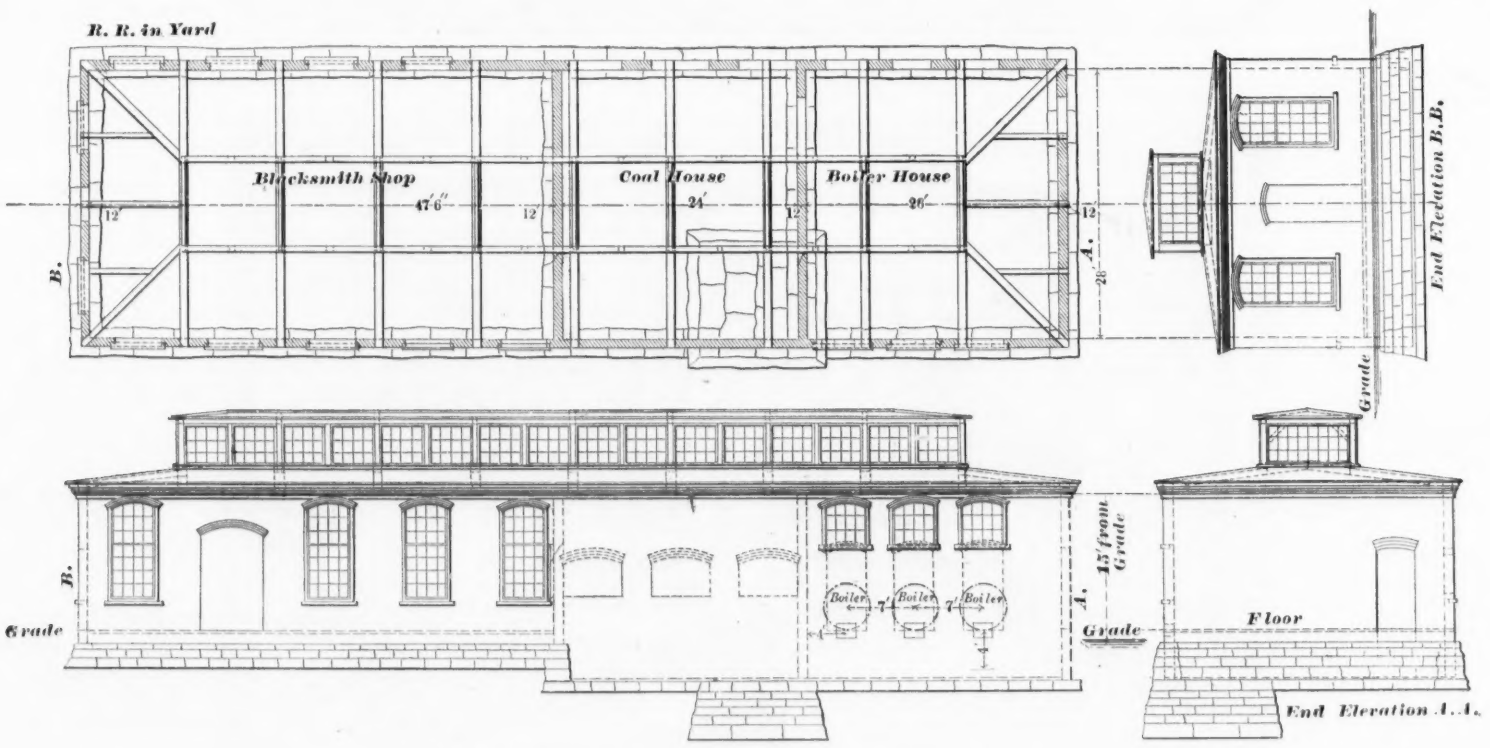
All parts of the work are made to gauges, so that they will interchange.

The second floor of the annex, over *A*, is now used as an office and drawing room.

The main belt is of hides which were passed through a splitter to reduce them all to even thicknesses, then the backs were all put together in the center of the belt. The joint is glued, and there is no uneven surface to rattle in passing over the pulleys. The belt being of a uniform thickness does not flop up and down, but runs quite steadily. There are no laced belts in the shop, all being glued together. The work of taking up belts is all done at night.



INTERIOR VIEW OF SHOP, LOOKING TOWARD THOMAS STREET.



PLAN, ELEVATION AND END VIEWS OF BLACKSMITH SHOP.

These shops were designed by, and erected under the supervision of, Mr. A. C. Rice, the present superintendent in charge of the works.

Boiler Explosions and Defects in 1882.

The *Locomotive* for February, 1883, published by the Hartford Steam Boiler Inspection and Insurance Company, contains 47 pages of valuable information for engineers and owners of steam boilers. It gives notes about each of the 172 boiler explosions that occurred during the year 1882, by which 271 persons were killed outright and 369 injured. These explosions took place among different classes of industrial establishments as follows:

Saw mills, and wood-working establishments generally	50
Steamboats, steam tugs, and steam vessels generally	24
Iron works, rolling mills, foundries, machine and boiler shops	18
Locomotives	14
Portable hoisters, and agricultural engines generally	6
Flour mills and elevators	8
Steam heating, drying, dwellings, public buildings, ranges, etc	8
Paper mills, bleaching, digesting, etc	7
Distilleries, breweries, malt and sugar-houses, soap and chemical works	4
Mines, oil wells, etc	10
Miscellaneous	20

In commenting upon these casualties, the *Locomotive* says:

"The list of explosions kept in this office does not include every accident that happens to a boiler, but only those that find their way into the papers. The number of these accidents is much larger than it should be, though, when compared with the number of boilers in use in the country, the percentage is small, being only about eleven one-hundredths of one per cent. of the whole. When careful and intelligent investigation is made into the cause of many of these explosions, it is found that the boilers have been worn out, overworked, or there has been some carelessness in construction, setting, or management. The tendency among steam users to hold on to old boilers and get a little more work out of them is altogether too strong; and a further tendency to add a little more pressure, when work is brisk, to already overworked boilers, has, no doubt, been the direct cause of many accidents. There is a demand for *more steam, more steam*, while the boiler capacity is not increased. Incompetent men are often employed to take care of boilers—men who are habitual drunkards, and utterly incompetent to have such responsible duties in charge. The desire to reduce expense leads to the employment of very inefficient and cheap help, and so long as this is done boilers will explode. Explosions are not confined to any special type of boiler. Wrought-iron, cast-iron, horizontal, upright, and sectional boilers alike have their troubles. No boiler can be regarded as safe under poor and inefficient management; while any well-constructed boiler of proper type, well set and under good management, may be regarded as safe. The best of men will sometimes be careless, or from thoughtlessness neglect some important duty; hence perfection cannot be expected in every one of the seventy-five or one hundred thousand, more or less, of engineers and firemen in the country. The record of defects discovered by this company during the year tells its own story. It goes to show that boilers are often found in much worse condition than their owners have any conception of, and these timely examinations have saved many establishments from wreck and ruin. This company has examined during the year between sixteen thousand and seventeen thousand boilers. They are used in all kinds of manufacturing establishments. Of this number, six have exploded, four of which were in iron works. In two cases leaks were discovered, but before the fires could be drawn and the boilers put out of use, they parted at the girth seams, and the different portions were projected in opposite directions. The hard firing which many boilers in iron works receive, and the carelessness in allowing currents of cold air to flow into the furnace and along the boiler bottom when the iron is being run off, also the feeding of cold water, are fruitful causes of disaster. The remedy against these accidents is apparent. Have your boilers honestly made, of good material. Don't buy this or that iron or steel because it is cheap; satisfy yourself that it is all that is claimed for it, and is properly branded and stamped as to quality. Buy your boilers of a maker whom you know to be honest and intelligent. Have your boilers well set; don't leave the work to any cheap bricklayer, who has no idea whatever of what is required for good draft and a proper distribution of heat along the fire surfaces of the boiler. It will pay in the end to employ competent men for this work. When the boiler or boilers are set, arrange to have them periodically inspected, which, with a sober, competent engineer in charge, will not only secure economy, but the danger of explosion will be reduced to a bare possibility.

The following summary of inspectors' reports for the year 1882 will prove interesting and worthy of preservation:

"During the year 1882 there were made 25,742 visits of inspection, an increase of 3,330, or nearly 13 per cent. over the number made in 1881. The total number of boilers examined was 55,679, an increase of 8,434, or slightly more than 15 per cent. more than were examined in 1881. The number of complete internal inspections foots up 21,428, being an increase of 3,838, or almost 18 per cent. more than were made in the previous year. This indicates a very gratifying increase of business. The hydrostatic test was

applied in 4,564 cases. The number of boilers condemned was 478."

"The number of defects reported was 33,690, of which number 6,867 were considered dangerous. Appended is a detailed statement of the defects found.

Nature of defects.	Whole number.	Dangerous.
Cases of deposit of sediment	3,138	467
Cases of incrustation and scale	4,913	450
Cases of internal grooving	237	112
Cases of internal corrosion	1,210	232
Cases of external corrosion	1,803	437
Broken and loose braces and stays	613	293
Defective settings	935	158
Furnaces out of shape	1,030	204
Fractured plates	1,801	902
Burned plates	1,084	412
Blistered plates	2,853	385
Cases of defective riveting	4,807	535
Defective heads	386	149
Serious leakage around tubes	3,414	845
Serious leakage at seams	1,957	342
Defective water guages	640	146
Defective blow-out apparatus	290	118
Cases of low water	131	84
Safety-valves overloaded	358	136
Safety-valves defective in construction	238	99
Defective pressure guages	1,808	344
Boilers without pressure guages	43	14
Defective feed pipe	1	1
Dangerous defects unclassified by inspectors	....	2
Total	33,690	6,867

These figures, showing as they do the most common causes of boiler accidents, may be profitably studied by all boiler users.

Moulding a Bevel Wheel—Bedding In and Turning Over—Machine Moulded Gears.

BY FOUNDRYMAN.

How far the introduction of machinery may influence the art of moulding in a way to render results surer and products more perfect, is as yet a matter of speculation. There are castings that in some localities are moulded and cast without much regard to the duty to be performed by them. Take as an illustration, gearing. It is claimed that gears moulded by machines are nearer perfect than those made from whole patterns, rammed up and cast in the usual way.

The common method of making moulds for gears is to ram up the drag or nowel, turn over, ram up the cope, remove cope, and draw the pattern, &c. This method will do for gears that are 18″ or less in diameter, and for wooden patterns up to 20″ diameter; but I believe that it is a practical impossibility to make a true spur or bevel gear 24′ or more in diameter by turning over with pattern in drag and rammed up.

There are several reasons why. First—It is impossible, or rather impracticable, to make a soft bed to receive the cleats of pattern board so that when rolled over all parts of the cleats and corners will bear equally on the bed, and where it bears lightest the mould will settle and produce a casting out of round, and the teeth at that particular place will be larger than those where the sand has not settled away from the pattern.

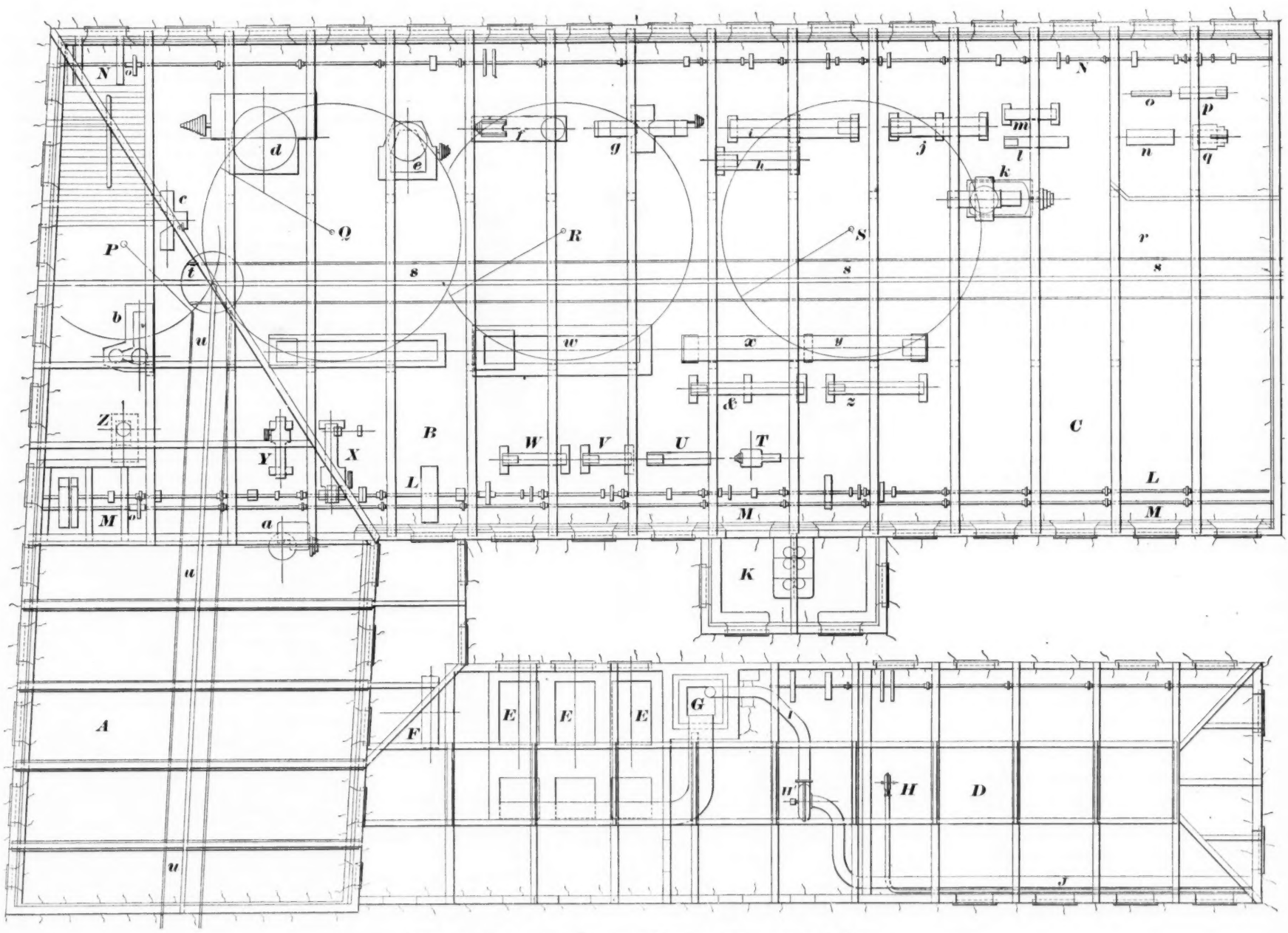
Second—In turning over the drag when rammed up as in common practice, the lower edge of flask (if square and of wood) bears on the floor and is compressed, and when on the bed it springs out, leaving the sides of flask free from sand. When the casting is poured, the pressure forces the sand out again, leaving the casting out of round. These imperfections may not be so radical in character as to condemn the casting, but the wheel will not run with the same accuracy as one bedded in and not turned over. In many shops this fact is well known, but the writer has been in others where the above remarks were as pure Greek. As an illustration: A bevel gear about 4 feet diameter for a horse power machine was given to a new hand in a shop to mould. He put his board down good and solid, then levelled up drag, and proceeded to bed in the gear.

The proprietor came in, and seeing the moulder's way was a new one to him, told him he had been to considerable expense to make a follow board for that wheel so as to get a true casting, and he would like to see it used. The moulder asked him if he ever made an absolutely true wheel. "Not exactly true," was the answer, "but much better than by any other way, excepting your present plan, and that I never saw before."

Says the moulder, "If this gear is not true when cast it will be because your pattern is not true." When cast and put on the boring mill it was found to be true, and acknowledged to be the only true wheel ever cast from that pattern.

Bevel gears of light rim suffer more than spur gears in rolling over.

Now, one important reason why machine moulded gears are nearer true than those made by whole patterns is the fact that they are not turned over, and the contents of flask wrenched and twisted in the process.



GENERAL GROUND PLAN OF THE HOLYOKE MACHINE CO.'S SHOPS.

The daily papers contain an account of the bursting of seven large grindstones recently at Mingo Junction, Ohio, by which seven lives were lost, and considerable damage done. It seems that the engineer absented himself from the engine room, and that during his absence the governor belt ran off, which resulted in an acceleration of speed sufficient to bring about the catastrophe indicated. One way, and a very simple one, to prevent an accident of this kind is to use a stop motion for all governors where the engine is driving work of a character where a material increase of speed will be likely to cause disastrous results—especially where human life is likely to be endangered. All builders of governors will supply them with stop motion for a small additional consideration, and as a matter of economy there are situations where a positive stop motion should be used. It is never wise to trust too much to the constancy of an attendant, and where it can be done so cheaply, the addition of an extra safeguard—which the stop-motion is—is the part of wisdom, even with the best attendance.

The *Water Gas Journal* is a new candidate for public favor issued in Philadelphia. L. P. Lowe is the business manager and Geo. W. Graeff, Jr., managing editor. Its introductory editorial begins thus:

"Water gas is neither a matter of the future nor an experiment. The some-time stumbling blocks in the path of its success have been, one by one, removed, and it is, to-day, in its different forms, the most efficient and economical force wrested from nature for the purposes of light, heat and power.

"Its conquests in the field of illumination have been constant, and throughout this country, where its successful generation owes origin, it is steadily, and at no sluggard's pace, driving out the older systems. Over a hundred cities and towns on the American Continent are now lighted by water gas processes, and to this number additions are monthly being made. As an illuminant, the gas is an established fact.

"As a producer of heat and power, it has shown results that confirm its claims. In these great departments of the world's necessities, its conquests will be as widespread as in the field of light."

Selling Machinery by the Pound.

By A. J. Shaw.

In the general machine shop, and by this term I mean the average country or provincial shop doing any kind of work from repairing a mowing machine to building a steam engine, the largest profits are usually obtainable on coarse, heavy work, and the shop that leaves off the most labor, and balances the account by putting in the largest possible quantity of raw material per man employed, will, other things being equal, make the most money, especially if it is very careful, as the provincial shop usually is, to misplace the extra material and put it where it is least wanted, and then conclude the operation by selling the production by the pound.

Most people have considerable respect for the bigness of things, and are more willing to pay an extravagant price for that than for other more desirable qualities. But there is one peculiarity in the case, that many want lightness where there should be weight, and weight where there should be lightness. Machinists even, many of them, desire and appreciate lightness and handiness in machine tools, and pile tons and tons of material into their shafting and pulleys, and are quite satisfied with this reversing of the proper order of things. I suppose the fact that in the one case they are buyers and in the other sellers, may have something to do with it.

The average buyer is fitting up a mill, and goes into the market and gets a lot of bids on his shafting and other mill-work, by the pound, of course, and as certainly gives the order to the shop which figures down nearest to the cost of the raw material, without a thought of the possibility, or rather of the probability, that the total cost of his outfitting may be far above what it would have been had he paid the highest nominal price for it.

As a rule, the shop making the clumsiest pulleys, the heaviest hangers, and using the "leadiest" babbitt, will bid lowest on a job—that is, by the pound. In these shops such a thing as balancing a pulley is almost a rarity. And why should they balance them when many of the lines of shafting which they furnish run at less than 100 revolutions per minute? I visited a large foundry not long since employing nearly 400 men, and doing an immense business. The main shaft was making about eighty-five revolutions, and was possibly not more that six or eight inches out of line at its worst place! It was driven by a belt twenty-eight inches wide, crawling along at but little over a thousand feet per minute.

Our shrewd buyer has, as we have seen, given his order to the lowest bidder, apparently a good business operation, but how does it work? Whether he had taken the higher or lower price, it is safe to assume that the value of the labor on the two bids was very nearly the same. Now the buyer must pay for this labor out of the difference between the cost of the "stock" and the price paid for the finished work, and evidently as this difference is reduced, a larger number of pounds of raw material must be put in to make up the deficiency.

For instance, A gets bids from B and C at 6 and 7 cents per pound respectively, for a lot of mill work, not to drawings, and as we have supposed gives the contract to B. Now let us see what it has cost him to save one cent per pound, starting with the perfectly legitimate assumption that B and C have equal facilities and make about equal profits.

They both buy their bar iron and castings at the same average price of say 3 cents. We will assume that the labor of fitting up this contract, together with a fair profit on same is $600. At this rate B will put in ten tons of finished work, for which A will pay $1200, and cannot cut down this weight without losing money, while C can do as well by getting out only seven and one-half tons costing but $1050; a loss to A of one eighth, surely worth looking after.

But the worst of the matter is that the difference does not end here. I suppose it is safe to assume that in the average manufactory, fully one-fourth of the whole power exerted by the engine is expended in overcoming the friction of shafting. Now, as the friction increases directly as the weight, the loss of power due to the heavier shafting and attachments amounts to something over 6 per cent., or if we place one-half of the surplus weight in the hangers, the loss is still over 3 per cent., besides entailing a permanently larger rate for oil and repairs. But we can hardly expect A to consider so small an item as 3 per cent. of his coal bill when he is putting in an engine and boiler whose voracity is only equalled by their general ugliness.

In a certain shop, the exact location of which is unimportant, are made among other things two machines, one of moderate weight, and requiring a large expenditure for highly skilled labor in its production; the other, weighing about the same, all the labor on it being of the very coarsest kind, and what there is not amounting to much more than turning a few bearings, and fitting up rough castings. On the first is a bare living profit, while on the second is a gain of 100 per cent. or more. This is a fair example of how the profits run on the entire line of work of shops in that region, as well as in many others. The machinery requiring exact workmanship and fine finish, hardly brings cost, while heavy rough work brings heavy profits.

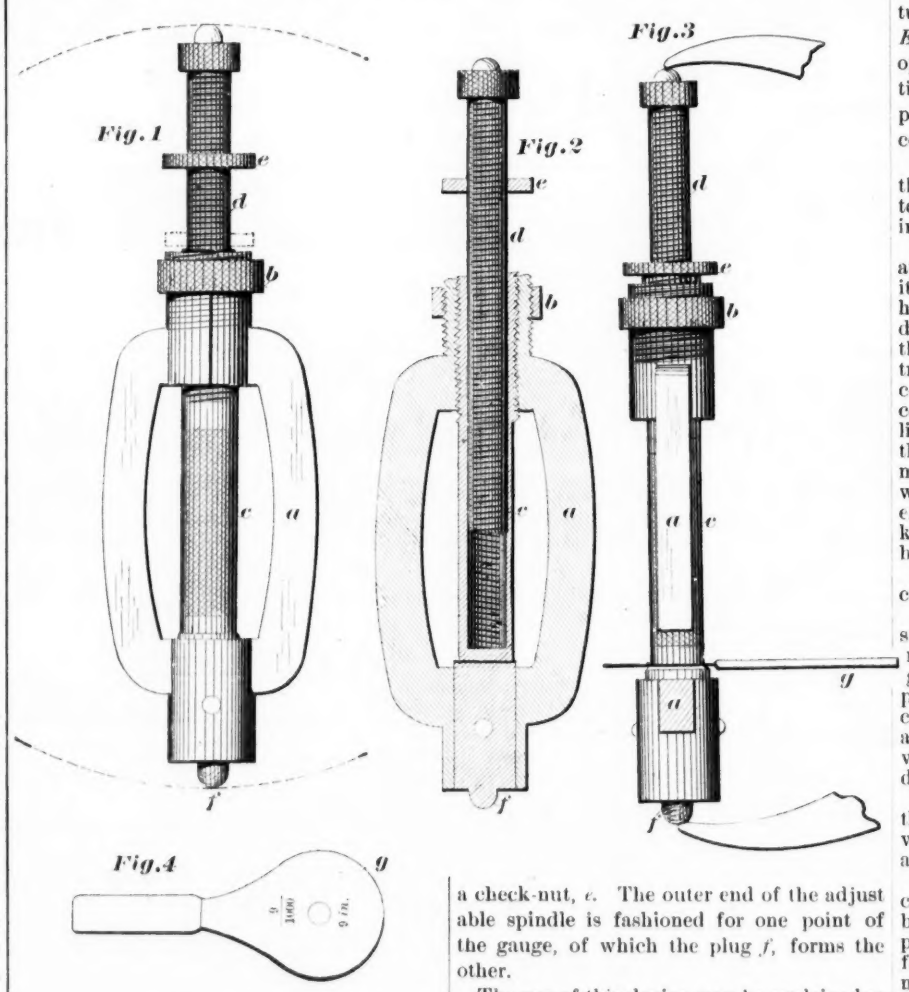
The kind of work most appreciated, is perhaps evidenced by the method which a foreman of one of the local shops adopted for correcting a surface plate of whose accuracy he had some doubts. It seems that he had attended an auction sale and had bought a nearly new standard surface plate, which had been very carefully made and was really accurate. After he got it he did not like the appearance of the scratches on its surface (the scraper marks), and proceeded to correct the plate after a very original method. His plan is worth knowing as it is the cheapest I have seen, and in proper hands is sure to give satisfactory results. The plate was put on a planer of unknown antecedents and the scraper marks very carefully planed out. The plate was then considered very accurate and used as a surface table for scribing off work!

Over $12,000,000 have been placed in the South during the past few years in establishing cotton mills. The average profit is said to be eighteen per cent., while the Northern mills yield an average of but seven per cent. profit.

Brown's Shrinkage Gauge.

Making shrinkage fits, although a common enough machine shop job, is one in which no small amount of difficulty is experienced, not in determining what the allowance should be, but in measuring that allowance in practical every-day shop work. To enable this to be done with dispatch and accuracy, getting rid of the element of uncertainty that usually attends such work, is the object of the little instrument shown in the accompanying engraving, and which is the invention of H. S. Brown, foreman in the machine shop of the Hartford Engineering Co., Hartford, Conn.

Referring to the engravings, Fig. 1 is a side view of the gauge, the dotted lines representing a portion of the inside of a cylindrical hole, in which the gauge is supposed to be inserted for the purpose of calipering its diameter. Fig. 2 is a vertical section of Fig. 1. In these figures, *a* is a frame, one end of which is in the form of a tapered split hub, the outside of which is threaded for the milled clamp-nut, *b*. This hub is also internally threaded to receive the tube *c*, and the tube is internally threaded to receive the adjustable spindle *d*, which is provided with



a check-nut, *e*. The outer end of the adjustable spindle is fashioned for one point of the gauge, of which the plug *f*, forms the other.

The use of this device may be explained as follows: The clamp-nut and lock nut, previously referred to, being loosened, and the bottom of the tube *c*, screwed into contact with the plug, *f*, the spindle is adjusted until the gauge exactly calipers the hole. In this condition the check-nut *e*, is screwed down, locking the spindle and tube firmly together, when the gauge represents the exact diameter of the hole.

At *g*, Fig. 4, is represented an expansion slip, which should be of a thickness equal to the amount of shrinkage proper to allow for the diameter of hole being fitted. These slips can be conveniently made in sufficient variety to suit the purposes of the shop by the use of the micrometer caliper.

After the gauge has been adjusted, as described, to readjust it, so that it shall indicate the proper size to which the shaft should be turned, the tube is screwed back sufficiently to admit the slip proper for the diameter be-being fitted. This slip is then inserted, and the tube screwed down hard upon it, when by screwing down the clamp-nut the whole is firmly fastened together, with the gauge of the size to which the shaft should be turned, the operation being indicated in Fig. 3.

It is hardly necessary to state that by reversing the operations with the metal slip, the correct diameter to which a hole should be bored to fit a shaft already turned may be determined with equal readiness and accuracy; also that the gauge is equally useful in making fits that are to be forced together by hydraulic pressure, or by other means where considerable pressure is to be used, the slips provided, of course, representing an increased diameter proportionate to the force it is desirable to use in pressing the parts together.

Consequences of the Prison Contract System.

A special prison committee of the New York State Legislature has been taking evidence in regard to prison management. It has shown the worst kind of brutalities have been inflicted upon convicts in most prisons. In the Kings County Penitentiary, however, the prisoners are treated like men. Some time ago when Warden Green took charge of that penal institution the convicts were treated like beasts, and their tasks made almost unendurable, yet every year there was a large deficiency. He has not only changed the treatment, but has made the receipts considerably exceed the expenditures. Recently a reporter of the *Brooklyn Eagle* interviewed Warden Green. His opinion of the contract system is very positive, direct and sensible. We copy below a portion of the interview relating to the contract system:

"You are, of course, willing to admit that a man who violates the law is not sent to prison merely for the purpose of enriching greedy contractors?"

"Certainly, I will admit that. It may appear strange, however, and yet I believe it to be true that, notwithstanding all that has been said about what has and is being done for the welfare of the convict, and the thousands of dollars that have been contributed by generous donors to alleviate his condition, the convict when discharged, receives no practical encouragement to begin life anew, and the resolution made in prison that he will, when released, go and sin no more, weakens day by day when, though willing, he finds himself unable to obtain employment, by reason of his imperfect knowledge of the trade at which he had been employed while in prison."

"What does your experience prove are the consequences of such a system?"

"Why, that the discharged prisoner resumes his former evil course and, in time, returns to prison. That, of course, is a good thing for the contractor, but are the people at large benefited by it? And, discarding all questions of humanity and justice and using an argument that ought to convince even a prison contractor, let me ask, does such a system pay?"

"You have spoken of the evil effects of the present contract system upon the convicts, how does it operate upon the law-abiding, industrious mechanic?"

"The system is no less disastrous to the citizen mechanic and his employer, because both are practically at the mercy of the prison contractor. For instance, a manufacturer employs citizen mechanics in any number, from twenty to five hundred, if you please, in the manufacture of a grade of work, somewhat different from that made in prison shops. He can without difficulty obtain a fair living profit, he prospers and his workmen are contented and happy; but some prison contractor decides to begin the manufacture of the same quality of goods, a step that can but result in the ruin of the manufacturer, who employs citizen labor. He will speedily be compelled to close his workshops and turn his men into the street, for it is manifest that he cannot pay them from $15 to $18 per week, and pay shop rent, while his competitor, the prison contractor, hires convicts at rates ranging from $1.80 to $3.60 per week, with rent free in shops, owned in part by the very people most injured. That is how the nefarious contract system operates."

The lumber trade of the South never before has been so prosperous. The consumption of lumber, timber, &c., for building purposes has fully quadrupled in the last two years. Great tracts of timber lands are being bought up and developed by Northern skill and capital.—*Southern Manufacturer and Builder.*

The more general use of wind-mills to furnish power for sinking shafts, etc., while prospecting to determine the advisability of permanent works, is being urged.

LETTERS FROM PRACTICAL MEN.

Tool Grinding.

Editor American Machinist:

I endorse Frank H. Richards' remarks on lathe-tool grinding. There is a right way and a wrong way, and a good workman keeps his tools the same shape from first to last, and they will cut equally well low as high. A bad, dumpy grinder gives the tool-smith more trouble and work than all the rest of the shopmen, and produces miserable work.

The universal English practice is to have an iron rest at the front of the stone. On this the tools can be held steadily, and a good pressure applied when required. The same rake, bevel, or angle can easily be kept, and a beautiful, clean, sharp, well-formed round point produced. When a tool is ground, the curve of a true stone and set the proper height, so as to clear freely but not too much, a roughing tool for wrought iron with water cuts beautifully, so does any tool properly ground.

Many shops in England have the grind-stones covered on the back and top with a sheet-iron case, and only the front exposed, so that a workman is compelled to grind his tools on the rest. This plan keeps the stones for machinists only, and prevents outsiders from spoiling it by letting heavy pieces bob up and down on the top.

In the old days, when hand tooling was the fashion, hook tools and other tools in long handles could not be ground without a rest.

It is easy, when a new man begins, to tell how he has been trained by his tool grinding. Heavy tools cannot be ground properly on the back or top of a stone, and if a man comes from a shop where a large wooden block is used for a rest, it may be noticed when he grinds a round point on his tools he will lift his tool off the rest and work it around against the stone, unsupported. In this way he cannot put any pressure on the tool; the consequence is, it becomes more and more dumpy every time he grinds it, and he soon takes it to the tool dresser to be reshaped and hardened.

It is an undeniable fact that men who understand the cutting principle of tools, and are particular in grinding them, not only do the best work, but give the toolsmith the least work; besides the saving in steel and time. The practice in New York, in my time, was to grind lathe tools on a rest. The other way is a threshing machine and rural practice.

I do not agree with Mr. Gray on the superiority of the "Yankee Notion" or weighted and tilted carriage for light work. The Vanhorn plan, of having the tool-block slide on the inclined plane, with a screw for raising and lowering, is just as quick an adjustment, and in my opinion much better, as it raises the tool square, is as rigid as a solid block, and the slides are inaccessible to dirt.

One good thing, in giving practical men the use of your columns, is, we get the views of men who have been trained in different schools. The English engineering publications on tools are generally from draughtsmen or civil engineers. J. K. C.

Fort Wayne, Ind.

Cleaning Screws from Rust.

Editor American Machinist:

S. E. M., Cincinnati, O., in Questions and Answers, (76,) in AMERICAN MACHINIST of February 17th, can remove rust from small screws, etc., that are too small for holding against an emery wheel by attrition. Take, say, one pound of screws, and place them in a small box; a cigar box will do. Put a small quantity of oil on them and shake for a minute; then put a piece of cotton waste in the box, and repeat for a minute; finally put a handful of sawdust in the box and shake for another minute or so, and remove the sawdust by sifting it from the screws in a fine sieve. The screws will be found to be as good as new. Larger quantities are apt to be ruined in a "churn." Have always found sharp corners, threads and points rapidly disappear in a churn.

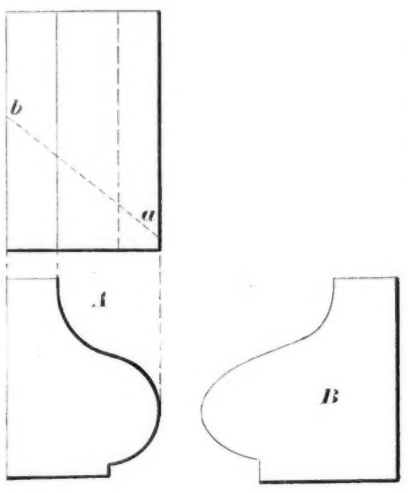
WM. H. RODGERS.

To Chill Cast Iron.

Editor American Machinist:

I have a receipt for the purpose of chilling cast iron very hard, which may be of some value to our friend in Ohio. Use a liquid made as follows: Soft water, 10 gallons; salt, one peck; oil vitriol, ½ pint; saltpetre, ½ lb.; prussiate of potash, ¼ lb.; cyanide of potash, ½ lb. Heat the iron a cherry red, and dip as usual. If wanted harder, repeat the process.

Lowell, Mass. C. L. CLARK.

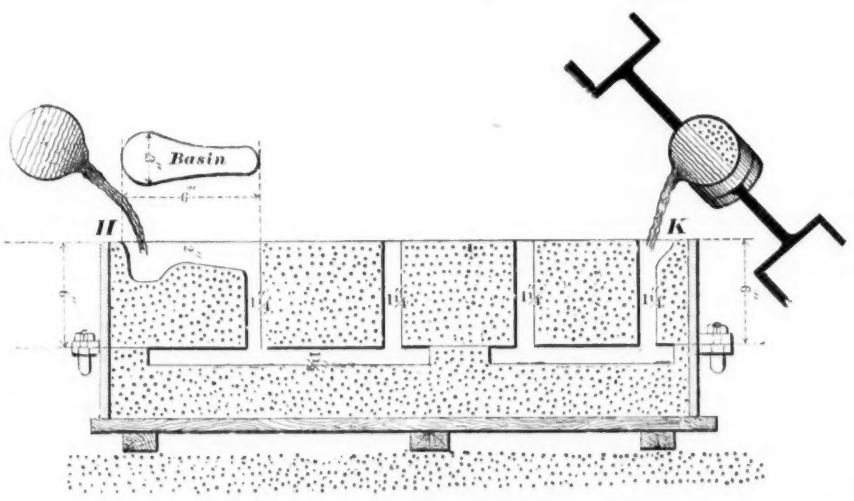


Making Moulding Cutters.

Editor American Machinist:

I submit a plan whereby D. E. S., can get the shape of his moulding cutters without making troublesome drawings, or using a paint-pot. In the engraving let *A* be the sample piece of moulding. Cut it off on the broken line *a–b*, at an angle of 53 degrees—not 45 as stated by some of your correspondents. Lay the surface cut (*a*, *b*), on a piece of paper, as at *B*, trace around it, and so much of the outline as is required will give the shape of cutter. I think this plan will commend itself, not only by its simplicity, but by its accuracy.

CHARLES W. GRIST.



Foundry Matters—Mr. West Replies to His Critics.

Editor American Machinist:

I sincerely trust that some of my critics that I propose to answer at this time, will pardon the delay, which has for various reasons seemed necessary.

Mr. Tullis and Mr. Jewett appear to be much of the same mind regarding weighting down flasks, each in his argument asserting that the momentum of the iron has nothing to do with the question. Mr. Jewett says, "if a cope lifts, it simply floats on the liquid iron." Mr. Tullis says a mould poured slowly will lift as much as if "poured with railroad speed"; also that it makes no difference how many ladles you use. If such were the case it would, of course, be easy to figure the exact weight needed. I do not deny that in many cases the *required* amount of weight can be readily obtained; to obtain the *exact* weight is another thing.

By Mr. Jewett's rule a cubic foot of cast iron would weigh 487½ pounds. This is wrong. By Mr. Tullis' rule it weighs 450⅛ pounds, which is about right; therefore to give this question a practical test, his rule should be used for common grey foundry iron.

Mr. Tullis argues that there are no conditions to be considered in the weighting down of copes; that it is simply a question of hydrostatics. To prove that there are other conditions to be considered, and also that the momentum of the iron at the moment many moulds become full, has an influence, I would simply ask any one to take a pattern $12\frac{1}{33}''$ square by $1\frac{1}{2}''$ thick, common rule measurement, and make four moulds, two of them to be poured as shown at *K*, and two as shown at *H*. Any one will admit that these modes of pouring cover the common manner of making pouring runners, as first receivers of the iron, as it is poured out of the ladle.

The mould *K*, if brought up quickly, would require more weight to hold it down than it would were it poured as shown at *H*. Either one of them, if brought up easily, or poured slowly, can be held down by having the cope and the weights weigh 230 pounds, but they cannot be poured as fast as possible, and be held down with that weight. Further, I will allow the use of 35 pounds more weight on *K*, than the head calls for, and even then the cope will lift if the metal is brought up fast. In both of these moulds I have given Mr. Tullis the full benefit of a riser. Should each be poured fast without a riser, there will be an increased momentum, and more weight will be required to hold them down. Fifty pounds extra added to the weight the head calls for would not hold down *K* if brought up fast. When moulding these plates, the flask was leveled and every cope was weighted, and weights added, until the exact amount required was found.

Mr. Tullis says I may throw in the weight of the cope if I choose. I have chosen to do so, in order to give his rule and argument a practical test, and show their error.

The article of mine which the gentlemen criticised appeared July 22, 1882, Mr. Tullis' criticism Aug. 19, 1882, Mr. Jewett's Sept. 9, 1882, and Mr. Treacy's, and Nutz, Aug. 26, 1882.

Another point Mr. Tullis finds fault with, is the expression that solid cold iron floats on the top of melted iron just as ice floats on water. The word *just*, he says, is calculated to mislead. I will not apologize for the use of the word, but will acknowledge that for a sharp critic it leaves room for criticism, but it is very evident that Mr. Tullis well understood the true meaning when he says it is calculated to mislead. Mr. Tullis' criticisms upon this point are not of the most conclusive character. He says: "Clean your iron of all extraneous matter; turn your piece of metal if you will; now thrust it into a ladle of the same metal, and my word for it it will not float 'just as ice floats on water.'" This might lead some to think that it would float just as ice floats were it not so cleaned or turned.

There is another point that Mr. Tullis criticises, and which I will, if possible, obtain facts to answer. He seems to think that we have evidence in the making of castings to prove that cast iron expands when becoming a solid. I do not deny this, but do say it is troublesome to prove it, and that his demonstration does not do so.

Mr. Nutz very kindly shows an error in my article on "Straightening Crooked Castings." There are two things which he says he practices that I seldom would approve of. The first is the way in which he allows castings to curl up in order to draw themselves back straight. There are many castings that will not go back. My second objection is to always making patterns crooked in order to have the castings come straight. This is a plan that in past years has been greatly practiced, but at the present day it would seldom be allowed. The moulder gets the pattern as the casting is wanted, and he must see that the casting is kept so in cooling.

Mr. Jewett has something to say about my cut of a pointed spindle. In answer to him I would say that were such a one ordered, the foreman machinist would soon convince one that such a point was of no practical use, and should it be insisted upon it would serve the moulder right if it did some day pass through his foot.

In reading Mr. Treacy's criticisms, I see that he sends out some hot shots, using taffy for a wadding. The first shot fired is at my "theoretical realm," as he calls it, and because some things are made so plain he seems to be greatly exercised.

He tells me to go to some metallurgist who thoroughly understands his profession, or a teacher in any of the polytechnic schools, and I will be told the reason with such a flood of the jargon of science as will make my head swim. Why didn't he tell the reason himself?

It is stated in the beginning of the article to which he refers, that "iron supports and floats a body the specific gravity of which is not greater than its own." Some cast iron will sink far below the surface, while again, some will in part project above the surface. The intention of the statement was to cause thought, and to show that the subject was somewhat complicated. I further said, if the same law held good with reference to both the water and iron, the iron when cold must be more bulky than when hot, and I think that it was fully shown that such was not the case. The word *just* may be distorted to a bad purpose by one so inclined, but the general reader, I think, knew well enough what was meant thereby.

He next takes exceptions to "weighting down copes." He contends that if there is no other reasons for a cope being raised than I have given, we can easily get a rule for weighting down flasks. Following this is the expression, "it will not take many experiments to find the difference in pressure between a head six inches and one ten inches high." I suppose if he had a head 14" high he would have to try another experiment to get the increased pressure. If Mr. Treacy would give this problem to a scientist he would be apt to laugh at him. I always supposed there was a mathematical progression as the height of heads increased, and that it was not necessary to try experiments to get the difference between every inch or so in height.

The third shot fired is at the V grooved weight. Now I would seriously ask Mr. Treacy if he actually thinks that his objection is worth noticing, and is it not true that nine-tenths of the foundries that would use such a weight, have a drop for breaking up bad castings and large pieces of scrap iron, and by the use of which they could break these weights much easier than with a sledge?

In his fourth and following shots he fires with a determination to hit something, and to find what he may have hit, I will follow him. The first we come to is my plan for bolting down copes. He thinks it good, but because of its being known before, he objects. He thinks my experience was gained on the prairies with a lot of Italians, and he says my plan of a double cinder bed is a very crude way of overcoming the difficulty of damp floors, and it would take a space of 24 feet in which to make a casting 6 feet square. In its place he would advise foundrymen to build brick pits. In my opinion any moulder that would advise the use of brick pits, or sinking an iron tank, for general green sand moulding, can, I think, have

had very little experience in using them.

I have worked in two shops in Cleveland that have caissons or iron tanks sunk to overcome the difficulty of wet floors. There is one in the shop that the double cinder-bed I described was used in, and by experience I know them to be a nuisance and a humbug; therefore I did not mention them. In a small shop that can be nearly enclosed in a tank or cement pit, or in a shop that has some specialty to make, the tank or cement pit is often a good thing, but for a general jobbing shop, there is nothing more vexing than brick pits or iron tanks. They use up room, are often in the way, and are not very desirable for green sand jobbing moulding.

As a general thing dampness is not found until you get from 2 to 6 feet below the floor level, and it is not every day that a jobbing moulder is called upon to dig so deep. If a shop's floor is damp up even with the surface, it will generally give trouble, no matter what is done. What will be a good plan for securing moulds for one shop, or job, will often be objectionable for others. The plan I gave was something new, and involves but little extra labor, and is one that can often be used to good advantage. The lower cinder bed is put in on a slant, for the purpose of drainage, and if the water is kept bailed out of the well or hole there is no trouble experienced, such as Mr. Treacy describes.

Mr. Treacy says: "with the bottom bed in this condition, what has Mr. West to screw down his cope to?" I am not crazy, nor do I think the readers of the American Machinist are. The drawing was made the same as all of them, that is, with a view to show as much as possible in the least space, and the article says plainly: "To make a bolting down floor as shown, a hole is dug as deep as is required, and bottom binders placed solid and level." Can heavy iron binders be placed solid in a bed of mud? I don't believe there is a moulder foolish enough to attempt to make or use a bolting down floor by letting the bottom binders and planks rest in a lot of mud and water, and had I mentioned that this bolting down floor was not to be made in mud bottoms, or ground, it would have been an insult to the intelligence of the readers of the American Machinist.

The next time my friend attempts to expose my unsound theories and unpractical and expensive plans, as he calls them, it would be well for him to remember that there is a difference between a racket and an argument. Thomas D. West.

Foreman of the Cuyahoga Works Foundry.

Cleveland, Ohio.

More About Planer Graduations.

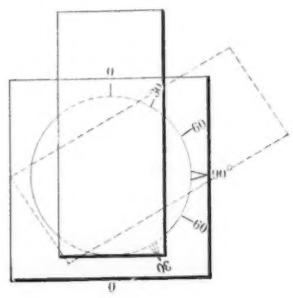
Editor American Machinist:

In your issue of Feb. 3d, M C. K., in reply to me, contradicts his own argument, and does not do what he says he does, viz., use the earth's surface as his base line.

In the first place he says, "what would a planer hand do if he had orders to plane both pieces a 40° bevel?" I think if he had a drawing and the boss told him to plane to the drawing, he would come out all right if he was a machinst. If he had to ask the boss, there is not one to be found who knows his business that would tell him to plane both on a 40° bevel if he wanted them as shown in sketches in Dec. 16th, No. 50, vol. 5.

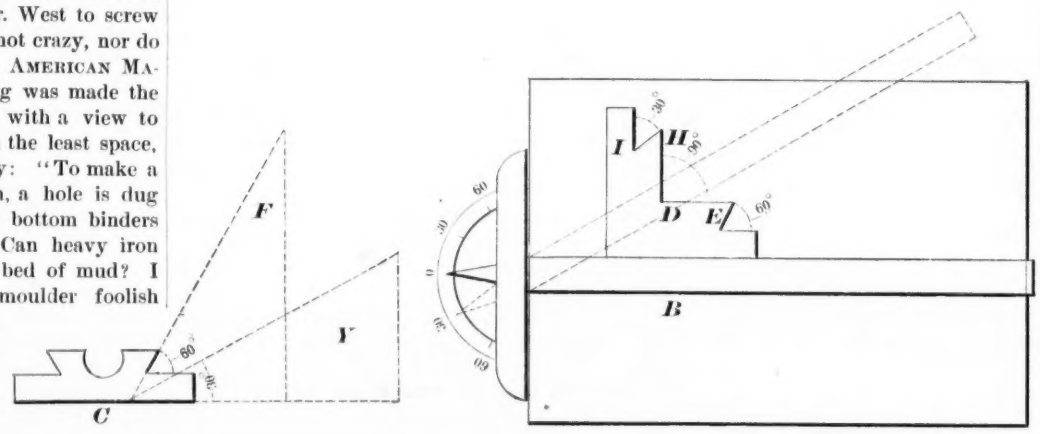
He says most manufacturers object to reading during working hours; then why not make your planers and drawings both right, so any workman can take his metal and drawings and work according to what his drawing says, and always come out right? I claim that builders do not work from platen when they mark their planers as most of them do, for when the swivel head stands at 90° it points to 0. Now, I would like to know from M. C. K. if he calls that right? I don't. There are planers marked with 90° on the side, or horizontal to platen, for I have run them, with brass pointer attached to swivel and graduated on cross slide. Gould & Eberhardt of Newark, N. J., mark their shapers with 90° on the side. We have one in our shop in use every day.

M. C. K. has the wrong idea about base line as regards the T square. The base line is the straight edge of blade, with pointer at 0 on the protractor (see sketch),



and not the edge of the head.

Suppose I give a man a piece to plane like sketch *B*, with planer marked like sketch. He sets his swivel head over to 30° for bevel, *H*, *I*, and back to 90° for *H*, *D*, and then to 0, for *D*, *E*, but as he cannot hold his tool with swivel in this position, he places it at 90°, and uses his cross feed, which amounts to the same thing. Then he sets it over to 60° for last bevel, which will correspond with protractor on T square, the platen being the base line, in other words, the earth's surface is the base line.



If everybody would use one line there would be no mistakes; and which shall we use, horizontal or perpendicular? If Mr. Smith would bring me a piece to plane like sketch *C*, and marked 30°, I would tell him that there was a mistake, for it is not 30° but 60°, as shown by dotted angle.

The graduations on planers should be marked on cross slide and not on swivel head, for you move your base line when you move your swivel, just as Mr. Smith did when he applied his protractor to the sketches. You can place the 90° anywhere on the circle you choose, only make your pointer on swivel correspond with 90° when swivel-head stands perpendicular to platen. The reason I put it on the side was for convenience. It cannot be seen at the top, so bring it down to the side, and do not forget to bring the pointer with it. If I were making a drawing of sketch *C*, and used my angle *F*, as shown in dotted lines, to correspond with bevel, what would you call it? Why 60 of course; you could not call it anything else, for it is a 60° and 90° angle, and *Y* is 30° and 90° angle, but our modern planers do not tell us so. I would like very much to hear through the columns of the American Machinist what M. C. K., or Mr. Smith, think of my argument.

Cleveland, O. J. M. Webster.

Wide vs. Narrow Belts—Special Tools—A Mistake.

Editor American Machinist:

I read your correspondence and "Letters from Practical Men" with a good deal of interest, and find in them information of much value. I have been especially interested in the various communications and articles on lathe beds, feeds, speeds, cone pulleys—in fact, in lathe construction generally.

One of your correspondents lays great stress on the virtue of a wide belt for lathes, or, in other words, has little faith in cone pulleys of large diameter and belts proportionally narrow. Now, I happen to have a prejudice in favor of the large cone, and the element of high-belt speed, which may be illustrated by—perhaps has in part grown out of—the change of the last fifteen years that has come over the belting of the machinery in cotton mills. This change has been entirely in the direction of higher belt speed, and beyond a question has accomplished important economical results in reducing the cost of belting to an extent that would hardly be believed, and correspondingly reducing the weight (and hence the cost) of shafting, pulleys, hangers, etc., while at the same time the driving of the machinery has been unmistakably improved.

The first to adopt the high-speed practice was the Quidnick Mills, Coventry, R. I. Before the change was made in these mills they used a 4-inch belt to drive a spinning frame, using a 6 or 7 inch pulley, and then the belt was quite likely to cause trouble by slipping. All the shafting and pulleys were taken down, and light shafting and pulleys were substituted. After the change was made, a 1-inch belt on a 14-inch pulley drove the frame with ease. A light narrow pulley overhead, no larger in diameter than the old heavy wide-faced one, drove with a 1¼-inch belt the countershaft, to which six frames were belted.

In my opinion, the best possible way to make a strong pulling lathe is to increase the diameters of the cone pulleys.

Another very important part of the subject is the selection of tools best suited to the purpose. I have considerable admiration for the English plan, which seems to be to make and use special tools for special purposes. If a lathe is wanted for use on work of small diameter, a plain lathe (without back gears) is used; if for large work, a back-geared lathe; and so with lathes for screw-cutting. In some shops, as where a general class of repairs are done, a lathe that can be adapted to almost any purpose may be desirable, but such tools on special work are not what is wanted. The parts and appurtenances that are not required for use not only add to the cost, but they are a constant hindrance, decreasing the efficiency of the tool. Special work requires special tools.

When I commenced in business, I wanted single-head lathes for my work. There were none in the market, so I had to buy back-geared, screw-cutting lathes. I stripped them of all their useless attachments, and have used them in this condition until they are about worn out. The tools were never as good for the purpose for which I wanted them as if they had been built without these (to me) useless appliances.

A mistake I often notice, especially in factory repair shops, is the placing of large, heavy lathes, capable of taking in the longest shaft in the mill. The shaft never needs renewing or repairing; hence never gets in the lathe. Should a shaft by chance be wanted, one could be procured already turned as quickly as the iron could be got to make one from, and it could be bought for less than it could be made. The result of such engineering is a clumsy, cumbersome tool that cannot be used to good advantage on the class of work for which it is constantly wanted. Two light, handy lathes could be put in the same room, and at the same cost, as the large one, either of which would be better adapted to the work An occasional heavy job can be done on a light lathe better than to be constantly doing light work on a large, clumsy lathe; hence it is not wise to shun the light lathe because it is not adapted to turn a locomotive, when the locomotive is not likely to require turning.

A mistake sometimes made in the construction of machine tools, as well as in other things, is in making a change for the sake of the change. To improve a machine is first to discover something wrong, and then to remedy it.

A cutting off machine is an important tool in a machine shop. By its use any number of pieces, such as studs, etc., can be rapidly cut to exact length, and by using a countersink with a shoulder the work is so far centered and squared; then with a single head lathe or two, with stop motion so as to turn to a shoulder without measuring, a boy can do more work of this class than three men can do by the old plan.

As new tools for special work are brought into use, and new plans of doing work are devised, the machinist must "turn from the evil of his ways," or be left behind. The intelligent, progressive machinist is abreast of any man in the world in what he does for the good of mankind.

John Birkenhead.

Mansfield, Mass.

Cupola Performance.

Editor American Machinist:

I notice in your issue of 24th inst., regarding foundry cupola, the following: "Eight thousand eight hundred pounds of iron have been melted in this cupola in one hour and thirty-five minutes, which we consider remarkably good work." Witherow & Gordon, New Castle, Pa., have a cupola 36″ diameter at bottom, 42″ bosh diameter, in which the common rate of melting is 10,000 lbs., of iron per hour. The cupola has six tuyeres 6″ diameter, placed 24″ to top, from bottom plate. The blower is a "Root." January 27th we put on blast at 4.30, had iron and plugged tap hole 4.38; melted 10,000 lbs. iron at the rate of 10.25 lbs. of iron to 1 lb. of Connellsville coke, and dropped bottom at 6.30 P.M. R. C. W.

New Castle, Pa.

Moulding Cutters—Length of Belt to Connect Two Shafts.

Editor American Machinist:

Allow me to say that the method given by S. B., of Rochester, N. Y., for laying out moulding knives, is the best I ever saw; likewise the quickest, and I am much indebted to the gentleman for the information. In the American Machinist of February 24th, G., of Bridgeport, Conn., says, with Mr. Reynolds, that 45° is the angle of the cutter when it gives the finishing touch to the moulding. This cannot be so; however G.'s method is a good one, if you have the right angle.

A few weeks ago there was an inquiry in relation to finding the length of belt to connect two shafts having unequal pulleys. I send you a rule which I use for this purpose, and which seems to be near enough right for practical purposes. Add the diameter of the two pulleys together, divide the result by two and multiply by 3¼. Add the product to twice the distance between the centers of shafts, and you have the length required.

D. E. Schrack.

Charging Drawing Pens.

Editor American Machinist:

I have a stylographic pen and find the filler very handy to use for filling drawing pens. Perhaps some of your readers have never thought to try this, and if so, I recommend a trial, believing they will be well satisfied with it. Apprentice.

[The instrument used for filling stylographic pens is what is known to druggists as a "medicine dropper." It can be procured at any drug store for a few cents, and we are inclined to believe will be found useful for the purpose named by our correspondent.].

Wear of a Slide Valve.

Editor American Machinist:

In your issue of February 24, J. S. asks some questions under the title "Peculiar Wear of a Slide Valve." If he will make his slide valve stiffer, and attach the stem by means of a strap, so that the strain of moving the valve will be upon the ends, he will find his trouble removed. W. B.

"Peculiar Wear of a Slide Valve."

Editor American Machinist:

In your issue of February 24, in "Letters from Practical Men," J. S. contributes a sketch of a slide valve and seat, and asks some questions about their rapid wear. The valve is a large one, the pressure on either end, at boiler pressure, being, I should suppose, from 1,600 to 2,000 pounds. If to this pressure is added the further aggravation of mud and grit carried into the steam chest from the boiler, and the valve is conceived as being dragged along at the speed mentioned, it will only be necessary to imagine a soft seat to account for the wear.

J. B. should advise his patron to wear out the present cylinder as soon as possible, and put on another one with less unbalanced port area of valve and seat, or use a balanced valve. Three or four tons unbalanced pressure on the valve of an 8″×9″ cylinder is going to extremes with a vengeance.

FRANK GLEASON.

A Cutting-off Tool.

BY FRANK H. RICHARDS.

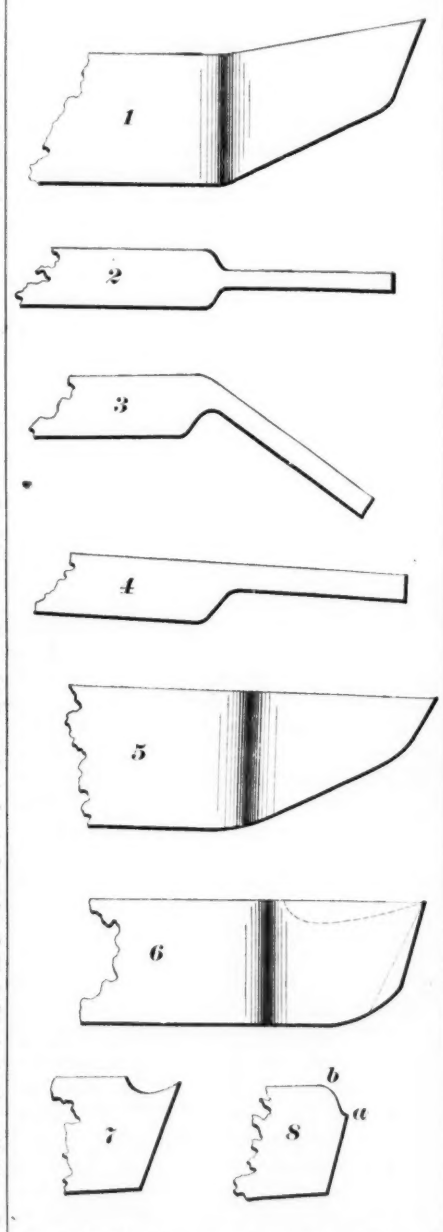
Of course every machinist who knows how to run a lathe knows, as the first essential, how to make and keep his tools just right. Of course, he who knows how to keep his tools just right, does so keep them. Does he? Look over a few tool-boards and express your opinion with caution.

I think there is no tool upon the board which will serve as a better gauge of the workman's status than a cutting-off tool. A perfect cutting off tool, capable of cutting cleanly, truly and freely, to profoundest depths, is an instrument to be admired. There is something about the operation of a cutting-off tool that has always been a mystery to me. It is that a tool made with proper clearance, and hard enough to keep its corners sharp, cuts enough wider than itself to leave it perfectly free. This may be seen on the planer where a square-nosed tool, if working well, will not lift out of the cut as the work runs back. The traditional and notorious perversity of things which the mechanic does battle against at every step of his progress seems to fail here, and the failure is greatly to the advantage of the metal-working community. Why a square-nosed tool does not jam in the groove that it cuts, but cuts wider than itself enough to make it perfectly free, is one of those things that I would be glad to have explained to me.

A good cutting-off tool is incontrovertible evidence of more than one most desirable quality in its possessor. It implies first, actual knowledge of the requirements of a good tool, the best shape for cutting, the right pitch and clearance, and temper. Secondly, as the tool in its preparation, even with all knowledge at command, requires some care and labor, and takes some time, it shows a habit of determined, intelligent and careful industry. Thirdly, and I think this not less important than the other particulars, it shows in the care and management of it the ability to "make haste slowly" by so grinding and using the tool that it will serve well for many future jobs besides the one in hand. If we go along thinking each job our last, we may grind the tool just for that, and after two or three grindings have to run to the blacksmith with it, and that is not good practice. A man who is an enthusiast in his calling comes to have a respect, and even a kind of affection, for the tools whereby his successes are achieved. It touches his heart and raises his ire to have one of them abused; he could not abuse it himself; he likes well enough though, to try its metal and put it to the proof.

Trusty is the crowning adjective for the instruments of human achievement. The trusty steed, the trusty blade and the trusty rifle, are historic. The trusty tool of the machinist is on the board of the expert workman, and it is not the tool that goes oftenest to the tool-dresser.

Tool-dressers are usually accommodating individuals; if one is not he is out of his place. I have never had any difficulty in getting what I wanted from him. Still, however kind and social he may be, I cannot recommend him for a frequent companion, nor as a rule does he desire the company of those who most persistently seek him. A prime objection to unnecessary redressing of lathe tools is that frequent reheating impairs the steel, and besides that the temper of tools is a matter of considerable uncertainty. The most expert and reliable tool-dresser cannot always temper tools alike, and when the temper of a tool is found to be just right, it



should be kept in use as long as possible. I would very much rather have a tool a little too hard than too soft; then if it is found to break off at the edge, provided that it has not been over-heated, grinding back once or twice leaves a very reliable and lasting tool.

While, as I was saying, a good cutting-off tool does its work admirably, it is very exacting as to its conditions. It insists upon them imperatively, and will not except compromises as other tools will. No tool upon the board will work so poorly if it is not right in itself and also rightly set. The essentials of a good cutting-off tool are several. The cutting edge must always be the widest part of the tool in the cut. There must be clearance both backward and downward. This clearance, while absolute in both directions should not be great. If the tool is to cut to a great depth it should narrow only for a short distance back and then continue straight, as if made a straight taper, all the way back to the root it would be too thin and weak, and be apt to break off bodily. Clearance is as necessary to the tool downwards as backwards, but it is as essential that it be equal on both sides. And here I may note that it has actually been discovered that tool steel as it comes in the bar, is not absolutely rectangular. Each side is more or less curved, the edges especially being high in the middle, and then it is rhomboidal. It leans over when you screw it up in the tool-post. Where is your equal vertical clearance then?

There have been about half a dozen machinists in the United States who at one time or another have been known to true the bottom edges of their tools so that they would stand upright in the tool post. There was never a manufacturer of tool steel who thought it worth while to make true steel, and I am afraid many a tool dresser, who shapes ever so carefully the point of a tool, would feel rather insulted if it was intimated to him that he had anything to do with truing the body of it.

I offer Fig. 1 as a profile of a cutting off tool. It may be straight like Fig. 2 or bent like Fig. 3. If a straight tool is wanted, I would have it in the middle of the steel and not at the side, as Fig. 4. Still there may be peculiarities about a piece of work, or even something about your tool post—don't ask me to imagine what—which make No. 4 the best. The reason for having the tool in the middle of the steel is that with that form the clearance is more likely to be equal at the sides than with the other. When the tool is forged it is a good practice to true up the sides with a file or, which is much better, with a good emery wheel before tempering. With the bent tool this initial grinding, especially of the inner side, is very necessary, as it is impossible to grind it upon the average grindstone.

It is barbarous to use a square-nosed tool just as it comes from the forge, without truing and polishing the sides of it by some means or other. The top of the tool should be level across. In the profile which I give the pitch of the top backwards is 10°. This may vary with the material it is used upon, but is a good average and would work well in anything but brass. The front edge of the tool must be straight and square; the projection of one corner in advance of the other would tend to deflect the tool to that side as it advanced into the cut. I have drawn the front at 60° to the top, which I think gives rather more clearness than is desirable for large work. This clearance will vary with the diameter of the piece operated upon. With a large diameter the tool, to retain the same cut, advances into the work at a less angle, and consequently require less clearance, than when working at a smaller diameter. Probably many men have noticed that in cutting off anything it requires actually and perceptibly more force to push the tool into the work as they get nearer the center.

When the tool is ready for use the last touch of the grindstone should be upon the front or cutting edge of the tool. Don't touch the sides last, as you remove an imperceptible burr, which helps to give clearance to the tool. Also in finishing the edge, it makes quite a difference, as to the lasting quality of it, in which direction the grindstone runs. Some still think this a notion, but I have satisfied myself of it by experience, and there are plenty who stand with me. The tool being upright in front of the grindstone, in its natural position as in the lathe, the face of the stone should turn downward toward it, and not upward and away from it. This of course applies only to the last touch of the grindstone upon the cutting edge and the "finish" thereby imparted.

A tool like Fig. 1, if set in the tool post perfectly true, with the cutting edge just the height of the center, may be fed right in to the center and cut right all the way. Without an elevating tool post it is not an easy thing to set a cutting-off tool just to the height of the center, or any other tool to any other desired elevation, and why tool makers will build, and proprietors of shops will buy small or medium sized lathes without means of raising and lowering the tool, is one of those things which they who run the lathes perpetually wonder at.

It is not customary for the tool dresser to raise the point of the tool as I have it in Fig. 1, because he finds that the average machinist will accept a tool with a flat top like Fig. 5. If ground well and set as high as possible, this tool will cut pretty well. Of course, it cannot be fed in to the center without lowering. When the point of the tool is found to be worn, though generally he waits until it is very badly worn and like a balky horse won't go any further, our machinist takes it to the grindstone, and, being industrious, he grinds it in a hurry, and, being a fellow of common sense, he of course grinds it where it is worn. This rounds off the top and squares up the front, and then we have Fig. 6. This tool might be reshaped on the emery wheel to the dotted lines, and, after being tempered again, would do good service, but it would have to be reshaped by another man. He who brought it to that shape was never since the world began known to so reshape it. His next move is to grind the circular notch in the front like Fig. 7. This is the tool-dresser's mortgage, and should be so recognized all through the trade. The inevitable foreclosure occurs when the tool comes to about the shape of Fig. 8, which is a sketch from life as accurate as my pencil can produce. That there may be no doubt in the minds of any as to the part—I can't say point—which is expected to do the cutting, I designate it by the letter *a*. If now it happens to be a little thicker at *b* than anywhere else, it will be perfect—of its kind—just too perfectly perfect for anything.

As a general rule, applying to all the forms of lathe tools I now think of except the diamond point, I would say keep the tops of your tools sacred. The grinding to make up for the wear that occurs should be almost entirely at the front of the tool, with only the slightest occasional touch at the top.

It is exasperating to look over a lot of tools and note how few men apparently realize, or care for, the necessity of having and preserving a good elevation to the point of a tool to give it an easy cut. If the grinding of tools were much more frequent, as soon as the least wear were discoverable, the tool would be found in the end to have done more and better and quicker work, and to have lasted longer.

The above are meant as hints of what may be said of a single tool upon the latheman's board. Any man of experience could doubtless add some valuable particulars. From the nature of its duty the actual performance of a cutting-off tool—I mean any square-nosed tool cutting endwise into a groove—can be closely stated. The actual performance of a side tool, for instance, it would be difficult to measure. Perhaps some of the congregation of the AMERICAN MACHINIST will rise and tell us of the time and other circumstances of their clean, true, and quick work with a cutting-off tool.

Engineering says: "In Germany engine-drivers are paid at rates ranging from £45 to £68 per annum, and are allowed a mileage at the rate of 8d. per five miles. Another allowance consists in a premium at the rate of 35 per cent. on savings in coal, and 15 per cent. on oil saving. Finally, 1s. 1½d. is granted for a night's lodging when the service takes them from home. An extra allowance is also made for work done in the shops."

It is generally understood that lumber this year is and will be cheaper than it was last. Other building material will also be purchasable at a lower rate. It is, no doubt, this favorable condition to those desiring to improve their real estate that is prompting much of the current inquiry about lumber.—*Northwestern Lumberman.*

That the folly of procrastination will yet be strikingly illustrated in the matter of the water supply of New York City, is every day becoming more probable. It might have been expected that, after the warning of the past three or four years, the authorities would have had some definite plan to offer, instead of which its consideration has just reached the condition of newspaper discussion, in which judging by the usual experience, it will linger as much longer. In the meantime, manufacturing and other interests must continue to suffer from an insufficient supply.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, F. F. HEMENWAY, } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET, (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST at 16/8 per annum, postage prepaid.

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$4.00 to Foreign Countries, postage prepaid.

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NEW YORK, MARCH 10, 1883.

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Disasters in the Iron Industry.

The recent heavy failures or suspensions of establishments in the iron industry have had, as might have been expected, a somewhat depressing effect upon all manufacturing interests closely related to the iron trade, and also upon railroad enterprise. If the causes of these large failures were obscure, or if they were such as are likely to move upon most other establishments in the same kind of business, ample grounds for serious apprehension would exist. Fortunately, however, the main causes of these startling business disasters are not hard to discover. When the iron trade was booming with increasing energy from week to week as it did two or three years ago, the stimulus to extend existing plants by erecting new mills and furnaces, often doubling and trebling the capacity of production, proved stronger than over-ambitious iron manufacturers could resist. Often the capital for making these extensions was partly or wholly borrowed, with the expectation of repaying it from the profits of the increased business within two to five years. Probably if the boom had continued until this date their calculations would have been verified, and we should have heard of no such iron failures as those that have recently occurred. As it was, orders for iron products fell off to something like the volume of trade experienced before the boom, prices declined, and expected profits could not be realized. There was no shrinkage, however, in a single dollar of borrowed capital, or the interest upon it, notwithstanding the fact that it took more iron, and consequently more time and labor, to acquire it. When certain payments became due and could not be met, with the prospect that a moderate extension of credit would only make the load heavier instead of lightening it, failures or compromises were necessary results. Those in the same business who were more prudent, and risked no more than what they could securely hold, even in the face of a depression of trade, can congratulate themselves upon the wisdom of their course. While those that are prudent must share in some measure the effects of a depression caused or intensified by the rashness of a few, they are not likely to be financially ruined by it.

The threatened radical readjustment of the tariff has undoubtedly had a bad effect upon the iron trade, checking many great enterprises requiring iron and steel, thus necessitating the shutting down of some mills and furnaces, and the running of other mills fewer hours per week. Orders for material for the construction and equipment of new railroad lines have been withheld in the hope or anticipation of extremely low prices following upon a heavy reduction of the tariff. Every week of this suspense has been the cause of losing millions of dollars to the business interests of the country. If the tariff is not to be changed at all until next year or perhaps later, some relief may be felt; but the security to depend upon, in the meanwhile, must be a strong determination of the American people to insist upon full and ample protection to our manufacturing industries.

Next Mechanical Engineers' Meeting.

The next regular meeting of the American Society of Mechanical Engineers will be held at Cleveland, O., some time in May or June. The exact time will hereafter be determined by a committee of the Council, after conferring with a Cleveland local committee. This will be the first meeting of the Society held west of the Allegheny Mountains, and the selection of Cleveland as the city in which to hold it is a good one. Mechanical engineering is well represented in Cleveland, and an active local society of engineers already exists in that city. It is expected that several interesting and plainly-intelligible papers will be read. We are somewhat in doubt as to how soon after the meeting these papers will be permitted to be laid before the mechanical public, as the rule in regard to their non-official publication was changed at the last Society meeting to read as follows:

The Society shall claim no exclusive copyright in papers read at the meetings, nor in reports of discussions, except in the matter of official publication, with the Society's imprint, as its transactions. The secretary shall have sole possession of papers between the time of their acceptance by the council and their reading, together with the drawings illustrating the same; and at the time of such reading, or as soon thereafter as practicable, he shall have printed copies of such papers, "subject to revision," with such illustrations as are needed for the transactions, for distribution to the members, and for the use of technical newspapers, American and foreign, which may desire to reprint them in whole or in part. The policy of the Society in this matter shall be given to papers read before it the widest currency possible, with a view to making the work of the Society known, encouraging mechanical progress, and extending the professional reputation of its members.

As the printed copies of papers read at the spring meeting, in April, 1882, at Philadelphia, have but very recently been sent "subject to revision," to members and to technical newspapers, it may be that the contents of papers read at the Cleveland meeting, "together with the drawings illustrating the same," will come to the view of members, at least, about the first of March, 1884, or perhaps, with increased expedition, four or five months earlier.

The new secretary, Frederic R. Hutton, will, we understand, open an office some where down town in New York City, probably on Cortlandt street, and have specified office hours in the afternoon, when he can be found by callers. In the forenoon, we believe, he will be found by members, and others having business with the secretary, at the School of Mines, 50th street and 4th avenue.

The membership of the Society has increased at a very satisfactory rate during the past year.

A Protective Fire Insurance Company Needed.

Edward Atkinson, President of the Boston Manufacturers' Mutual Fire Insurance Company, has issued to the mills in that association a pamphlet entitled "The Protection of City Warehouses from Losses by Fire." The mills store their goods in warehouses in the principal commercial cities where the factory mutual insurance companies take no risks. This pamphlet submits plans whereby the risk may be lessened.

It appears from a recent report of the underwriters, that during a portion of every day, when a heavy draft is made upon the water pipes in the upper part of New York City, there is no pressure upon the hydrants at the street level in one of the most important down-town districts, where the buildings are very high. Mr. Atkinson calls attention to the fact that five years ago he submitted a plan for the protection of city blocks by means of 5-inch stand pipes at two corners of a given acre of buildings, more or less, to which might be attached horizontal 4-inch pipes upon the roofs, fitted with hydrants on each side of each party wall. Such pipes were to be carried around each square of buildings, so that each building could be flooded from at least two points, and so that many streams could be directed from any one block against a fire on the opposite side of either street surrounding it. The power could be applied from the stand pipe at the corner most distant from the fire. The cost, when iron pipe was much higher than it is now, was estimated to be $2,000 an acre. To his former plan Mr. Atkinson now adds a proposition that one large steam pump shall be used to every acre, more or less, and that this pump be placed under a street or sidewalk, or alleyway, to be operated by steam supplied by one of the steam heating and power companies, or from any boilers that are in constant use. The pump should be supplied with water not only from the street mains, but from wells, one at least to each acre. He suggests that a less number of larger pumps drawing water from the docks might prove to be a better method, but such points are matters of detail only. These pumps could also be kept in use, the men employed and a revenue derived from pumping water for operating hydraulic elevators. With this apparatus once established and in use, one-tenth the rate of fire insurance could be saved, equal in amount to about twenty per cent. upon the computed cost of pumps, pipes, and roof hydrants for 100 acres of New York City. But what corporation will apply such an apparatus, and reduce the danger from fire?

Mr. Atkinson very truly remarks that "the present risk and waste of property by fire will continue until it can be made apparent that it will be *profitable* for some person, firm or corporation, steam-heating company, or fire-prevention company to apply the remedy." He suggests that a protective fire insurance company be organized something after the plan of the Factory Mutual System, with a sufficient capital, in whose method of work may be combined protective apparatus, the supervision of risks, the advice as to safe construction of buildings and the economy in expense of the mutual companies, with the security to the assured of the invested capital of a stock company. The great success of the Factory Mutual companies would seem to be precedent enough to warrant the organization of such a company to protect city buildings.

As a rule, railroad earnings for January this year, as far as they have been ascertained for publication, show an increase over earnings for January, 1882. The roads in the northwest have been so blockaded with snow that as might be expected their earnings show some decline. In the southwest, on the other hand, a wonderful increase in revenue over the corresponding period of last year, is shown.

Literary Notes.

HANDRAILING AND STAIRCASING. By Frank O. Creswell. Cassell, Petter, Galpin & Co., Publishers, 739 and 741 Broadway, New York. Price $1.50.

The object of this little book is to treat in a practical manner the designing and construction of handrails and staircases. Accordingly the author commences by showing the importance of sketching that which the workman desires to work, and fully illustrates how the beginner should proceed. This plan of illustrating the subjects discussed is kept up throughout the book in a manner calculated to make the matter plain to almost anyone, and at the same time to present drawings of real value. Altogether, the intentions of the author to offer something that should encourage the workman to study and to think of his work, while affording him practical information on what is perhaps, properly considered, the "highest branch of joinery," seems to have been well carried out.

CUTTING TOOLS WORKED BY HAND AND MACHINE. By Robert H. Smith. Cassell, Petter, Galpin & Co., Publishers, 739 and 741 Broadway, New York.

This is a book of 241 pages, illustrated with 14 folding plates and 51 wood-cuts. The author, in his preface, disclaims any intention of trying to enumerate all the cutting tools in use, his aim, as stated, being "to begin the elevation of the art of toolmaking from its present entirely empirical to a more scientific position." He begins with chisel tools for wood, showing the analogy between the action of the chisel, axe, wedges for splitting, and other similar tools. In the chapter devoted to this class of tools, he gives the power required to pare wood with the chisel and shave, as well as practical hints on grinding and setting the edges of such tools. In succeeding chapters the classification and description of tools are continued, and all the common tools, and many of the machines used in wood and metal working, are considered. The cutting speed of various tools, and the power required to operate them, are in many instances given, as well as the effect of faulty construction and the principles of good construction. The book is written in a style that can be readily comprehended by the ordinary reader, and to those identified with

mechanical pursuits in which cutting forms a part of the operations, it cannot fail to be of value, while those interested in the scientific classification of cutting tools will be well paid for its perusal. It is sold for $1.50.

THE TRAVELER'S OFFICIAL GUIDE of Railway and Steam Navigation Lines of the United States, is the most complete and reliable railroad guide we know of. It is published monthly by the National Railway Publication Co., 46 Bond street, New York, and contains each issue about 450 pages, with maps, time tables and index to railroad stations.

John Wiley's Sons, 15 Astor Place, New York, who have recently been appointed sole agents for *Engineering* for the United States, send out a circular in reference to that publication. *Engineering* is undoubtedly the leading newspaper of its class in Europe. Its writers are among the best known in England and America. The subscription in this country is $10 on thin paper, or $11 on thick paper, mailed direct from the London office. The circular says: "Sample copies will be furnished on application, free of cost."

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(93) Andy, East St. Louis, Ill., asks: 1. How shall I find the heating surface of a horizontal and a vertical tubular boiler? *A.*—The heating surface of any boiler is the surface that is exposed to the fire, and to the products of combustion on their way to the chimney. In a horizontal tubular boiler it is generally one-half the surface of the shell, *plus* the interior surface of the tubes, and so much of the heads as are exposed to heat. In vertical tubular boilers, the surface exposed is the furnace, *plus* the interior surface of the tubes. 2. How can I determine the proper grate surface for a boiler? *A.*—The grate surface is usually proportioned to the heating surface, being in the proportion of from 1 to 20 to 1 to 35. 1 foot of grate surface to 30 feet of heating surface is perhaps about the average for stationary boilers. 3. How many square feet of grate surface equals 1 horse power? *A.*—One-half foot of grate surface to a horse power is a fair average for natural draught. 4. How can I find the cubical contents of a boiler? *A.*—See answer to question 53, Feb. 3, 1883.

(94) P. R., Columbia, S. C., asks: Please tell me the horse power of engine and boiler of the following dimensions: Engine cylinder 12″x20″, ports 1″x6″, steam pipe 2½″, with Judson governor; fly-wheel 8 feet diameter, weight 2,000 pounds. The boiler is 4 feet diameter, 14 feet long, with 50 tubes, each 3″ diameter, and 12 feet long. The engine to run 80 to 100 revolutions, with steam pressure at 80 pounds? *A.*—The ports and steam pipes are too small to develop full power. If close governing is not essential you probably can calculate on a mean effective pressure of about 35 pounds with which the horse power would be, say, at 300 feet piston speed: $\frac{111\times300\times35}{33000}$=32 indicated horse power. The boiler, if well set, should just about furnish steam for the engine.

(95) T. M., Dayton, Ohio, asks: What is the effect of a forced draft by means of the exhaust steam in increasing the capacity of portable engine boilers? *A.*—The capacity can be increased to almost any extent by submitting to a proportionate loss in back pressure. In the locomotive boiler, for instance, three or four times the amount of steam is made that would be made with the same boiler used without forced draught and with a smoke pipe of say 60 feet in height. It is not customary to go to this extent in the case of portable engine boilers. From a large number of examples we find the average heating surface to be 9 feet per effective horse power, which probably represents very good practice in this respect. Some builders use considerably less heating surface per horse power than this, while others use more. Very few, however, use as much as they would use in the case of stationary engines and boilers, claiming, and probably correctly, that it does not represent the best economy to do so.

(96) J. H. H., New York, asks: 1. What would be the safe working pressure for a boiler 48 inches diameter by 42 inches long, the shell being 5-16″ iron, and the longitudinal seam double riveted; tensile strength 50,000 lbs. The fire box is a 24 inch flue made of 5-16″ iron? *A.*—The fire box is probably the weakest part of the boiler. We should say a safe constant working pressure for such a fire box would be 70 lbs. 2. Would 100 lbs. to the square inch collapse the fire box? *A.*—No, not if properly made and in good condition.

(97) G. W., Tower City, D. T., writes: Will you please tell me whether the water from an Artesian well, of which the following is an analysis, is suitable for use in a boiler:

	Grains in one U. S. gallon.
Sediment	none
Solid matter, upon evaporation to dryness	189.000
Scale (deposited on evaporation to 1-10 bulk)	4.894
Silica	0.194
Alumina, Oxide of Iron	0.374
Lime	3.604
Magnesia	0.114
Carbonic acid	not det.
Sulpheric acid, free	none
Sulphuric acid, in combination	31.990
Chlorine, free	none
Chlorine, in combination	6.880
Potash and Soda	residum

A.—We have submitted your question to J. M. Allen, President of the Hartford Steam Boiler Inspection and Insurance Company, who courteously replies as follows: "The analysis is a little blind. Solid matter 189 grains in one U. S. gallon. As we interpret this analysis the bicarbonate of soda is very unusually abundant. In our opinion the result of using this water in a boiler would be to deposit a heavy 'sludge'—mostly soda—which if not frequently blown out would be very injurious. The water is a mineral water, and we would not advise its use in boilers if water from any other source can be obtained. We often use soda to remove scale of certain kinds from boilers, but such an excess of soda we feel sure would give trouble. This water would work much like sea water, only in our opinion it would be much worse."

(98) D. S. H., Corpus Christi, Texas, asks: Of two locomotives, one with six foot and the other with four foot driving wheels, which will make the first mile from the start in the shortest time? *A.*—It will depend upon the train. Other things being equal, with a light train the one with the six foot wheels would have the advantage, while with a heavy train the advantage would be in favor of the four foot wheels.

(99) G. S., Harrisburg, Pa., asks: Which reamer is best for general machine shop use, a long fluted reamer or a short rose bit reamer? *A.*—No comparison can be made, because the two tools named are used for different purposes. The rose bit is generally used for approximately sizing holes in the lathe, and the other for accurately sizing them by hand.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass.

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J

James W. See, Consulting Engineer, Hamilton, O. Mechanical Engineer. Complete motive power outfits a specialty. Peter Banta, Cold Spring, N. Y.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

J. C. Hoadley, Engineer and Expert, 28 State St., Room 28, Boston, Mass.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

For sale, 25″ lathes of best designs from new patterns. George A. Ohl & Co., E. Newark, N. J.

Chas. T. Porter, Mechanical Engineer, Tribune Building, (Room 42,) New York City.

Consulting Engineer and Mechanical expert, C. C. Hill, Room 8, Ulich Block, Chicago, Ill.

Machine designing and general engineering work. T. J. Winans, 54 M. & E. R. R. Av., Newark, N. J.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cts. E. Lyman, C. E., New Haven, Conn.

Steel Forgings, either plain or crank, up to 10,000 lbs. in weight. Address, Pennsylvania Steel Co., 160 Broadway, New York.

Light and fine interchangeable machinery to order. Foot and power lathes, slide rests, &c. Catalogue for stamp. Edwd. O. Chase, Newark, N.J.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

Boring Bars made all sizes for all purposes to bore both straight and taper work. Pedrick & Ayer, proprietors, L. S. Flanders' Machine Works, 1025 Hamilton street, Philadelphia, Pa.

"Patent Binder" for the AMERICAN MACHINIST holds 52 weekly issues in good shape. Sent to any address by mail for one dollar. American Machinist Publishing Co., 96 Fulton street, New York.

Free—"Useful Hints on Steam." A book of 96 pages, illustrated. Valuable to engineers, steam users and those about purchasing steam machinery. By mail, 15 cents, or free on personal application. E. E. Roberts, 107 Liberty St., New York City.

We have issued Steam Users' Business Directories for New York and New Jersey, Pennsylvania and Ohio, and have in press an edition for the New England States. They embrace the names of over 40,000 Steam Users. Manufacturers and Dealers in Steam Goods and Specialties will find valuable lists for reference, canvassing, or mailing price lists, etc., not heretofore published. The J. N. Mills Publishing Company, 165 Broadway, New York.

MANUFACTURES.

The Chicago Malleable Iron Company is employing 700 men in its works.

The Lima Iron Fence Co. in Lima, O., will soon enlarge its works by building a new foundry.

The Derby Silver Company, of Derby, Conn., has voted to increase its capital stock to $300,000.

Independence, Iowa, talks of raising $30,000 capital for the purpose of erecting a plow factory.

It is proposed to increase the capital stock of the Glamorgan Iron Company, of Lynchburg, Va., to $80,000.

There are 4,326 manufacturing establishments in Tennessee. They represent $20,000,000 capital, and pay employes $5,000,000 annually.

The National Sugar Manufacturing Company will erect a large factory in York, Pa., for the manufacture of sugar from beets.

The Bellaire, Ohio, Nail Works, have just ordered another 8 per cent. dividend. This is 13 per cent. in six months, and 48 per cent. in two years.

The Merrick Thread Company, of Holyoke, Mass., will soon begin the erection of a building 270x90, three stories high, in order to have more room for business.

The Oxford Iron Works, at Belvidere, N. J., idle for some time past, have been reopened by a new company. The works employ several hundred men.

It is said that the Griffin Car Wheel Co., of Detroit, will establish a branch foundry in Buffalo, N. Y., in the building formerly used by the Buffalo Iron Works at Black Rock.

The Wheeler Iron Company have removed their chain works from Cuyahoga Falls, O., to West Middlesex, Conn. Their capacity is five tons of chains per day.

The Lawrence Manufacturing Company, of Lowell, Mass., have recently completed the erection of two one-story brick buildings, about 138x48, and 130x48 respectively.

The Chicago Die and Machine Works are building for a new manufacturing concern in this city, says the *Industrial World*, six lathes, and are busy on other work.

The Steel Ore Company, of Pottstown, Pa., composed of Gabel, Jones & Gabel, have leased the furnace at Bechtelsville, Berks county, and changed its name to Norway Furnace.

An addition is to be built to John R. Whittemore's agricultural works at Chicopee Falls, Mass., in the spring, and Ezekiel Blake will occupy it and manufacture knitting-machine needles.

It is said to be quite probable that a large mill for the manufacture of wood pulp will be erected on the site of Robertson Brothers' old manila mill at Holyoke, Mass., in the spring.

Duncan & Baldwin's new stove and range foundry immediately south of New Castle, Pa., which is to employ some 300 hands, will be ready to resume operations about April 1.

The Phœnix Iron Works, Meadville, Pa., which lately had one building destroyed by fire, are erecting a new fire-proof building about one-half larger than the old one. They expect to occupy it about the middle of March.

The Tanner & Delaney Engine Company, of Richmond, Va., have about completed new shops, covering about twelve acres, that are said to be unsurpassed in the United States. They represent a cost of $350,000.

The Chase Turbine Manufacturing Company, at Orange, Mass., are laying the foundation for their new shop, on the site of the burned chair shop. The new building will be 125x50 feet wide, with an L 60x50 feet wide.

The Hartman Steel Co., a new concern composed of well-known capitalists, has purchased the works now under construction by the Beaver Wire Co., Beaver Falls, Pa. The works will be completed and put into operation.

It is stated that the Union File Co., of Baltimore, have been offered 4,000 pounds of ivory in exchange for files, by a resident of Cape Coast, on the west coast of Africa, and he agrees to furnish all the ivory they can dispose of, in trade for their product.

The Curtis Regulator Company of Boston, are doing a good business in regulators and steam-traps. They have recently supplied the Freeman Manufacturing Company and the Massachusetts Mills, and are sending large numbers to New York and Chicago.

John Kimbel & Co., West Falls Avenue, have built an addition to their foundry, thus increasing their working capacity about one-third, and are now turning out a large amount of work. Orders have come in lively, and they have been working night and day.—*Baltimore Manufacturers' Record.*

Several companies have recently gone into operation on the St. John's river and on the Atlantic coast in Florida, and have erected extensive works, with a view of manufacturing oil and fertilizers from the fish they capture. A bill for the protection of food fish has been introduced in the Legislature.

McEwen Bros., Wellsville, N. Y., have from 45 to 50 men at work making engines, boilers, tannery castings, circular saw mills and mill gearing. They are about to bring out a new automatic cut-off engine. Business is brisk, and they will build a new iron foundry 50x100 feet early in the spring.

The Crowell Manufacturing Company, Greencastle, Pa., which was incorporated in December, with a capital of $140,000, to continue the manufacturing business of Crowell & Co., established many years ago, will hereafter, in addition to the agricultural implements formerly made, engage in the manufacture of steam engines, saw mills and other machinery.

The Atlas Engine Works, Indianapolis, Ind., write us: We have contracted with Messrs. Morrow, Hamby & Co., lessees of the State Penitentiary at Rusk, Texas, to furnish the new machinery required for their shops; consisting of two Corliss engines, one slide valve engine, 5 boilers, steam pumps, heaters, and complete pipe connections. Our business is excellent, and the prospects look very bright for the coming season's trade.

The interests of John C. Morris and Ezra Cope, in the Cope & Maxwell Manufacturing Co., Hamilton, Ohio, have been purchased by Alex. Gordon, Robert McKinney and James W. Gaff, of Cincinnati. Mr. Maxwell retains his interest. The new firm will be known as the Gordon & Maxwell Manufacturing Co. The purchasing parties are the president, treasurer and manager and the secretary of the Niles Tool Works and the shops, added to the Niles, will make a very strong corporation.—Cleveland *Trade Review.*

Two gentlemen in New Bedford, Mass., have been agitating the subject of starting a paper mill, to be established in the building known as Hawes's Hall, on the west side of County road, north of Laud's corner, and $12,000 of the $20,000 required has already been subscribed. The paper to be manufactured is of two grades—such as is used under carpets and for sheathing. The paper is to be made from the bark of cedar trees, and the factory is adjacent to water, which will be utilized for soaking stock.—*Manufacturers' Gazette.*

Edward Smedley and C. H. Meyer, proprietors of the National Iron and Brass Works, are a new firm at Dubuque, Iowa. They manufacture locomotive bell-ringers, also brass fittings of every description. Their works have now been in operation about three months. The buildings consist of a machine shop 120x40 feet in dimensions; brass and iron foundry 140x40. At present they give employment to 40 men. Their shops are supplied with all the modern and most improved machinery for the manufacture of steam pumps, and the firm enjoy special advantages, as regards location, for the western trade.—*Industrial World.*

According to a circular issued by the Westinghouse Air Brake Company the number of their brakes now in use throughout the world is as follows: In England, 15 railroads are supplied with them on 1,312 engines and 9,665 cars; France, 10 roads, 1,443 engines and 8,369 cars; Belgium, 1 road, 359 engines and 2,006 cars; Germany, 4 roads, 65 engines and 143 cars; Austrian, Russian, Holland, Italian, Swedish, Indian, New South Wales (Australian) and Victorian roads have adopted the brake. In the United States, 241 roads use it on 3,534 engines and 15,347 cars. The increase in the last two years is 4,672 engine and 22,716 car brakes. Total number in use 10,697 engine and 47,465 car brakes.

The Fall Mountain Paper Company, Bellows Falls, Vt., owned by Messrs. Wm. Russell & Co., of Boston, are erecting a large furnace to burn their waste wet chips and bark from their wood pulp works. The chips and bark are pressed in a hay press. The boiler for this furnace is being made by Richard Dobbins of Lowell, Mass., and will be of Benzon steel 6′×17′. This will be set by the Jarvis Furnace Company of Boston. The fuel will be green and wet, but the application of hot air on top of the fire, will by the Jarvis system give an intense heat, so much so it is said that a boiler set this way will make double the steam of one using coal for fuel. This is the second furnace of the kind they have set this way; the first was tried in Franklin, N. H. This company has twenty-nine Jarvis furnaces in their different mills.

The Pittsburgh *Commercial Gazette* of the 7th inst. says: There is a prospect that ax making at Beaver Falls will be resumed before long. On November 9, Hubbard, Bakewell & Co., closed the ax department of their Beaver Falls establishment, throwing eighty-two men out of employment. The men are still idle, and as the probability of going back to their old positions has been none too great, they are considering the erection of a co-operative factory. Offers have recently been received from both Youngstown and Canton, agreeing to furnish the ground and subscribe $5,000 in stock if the men will build a co-operative factory, an idea that is favorably looked upon. Last night a meeting was held in Beaver Falls to discuss the project, but no action was taken except to appoint a committee to investigate the offers from Youngstown and Canton. The people of Beaver Falls do not want the ax makers to depart. Many of the men own their homes and they are valuable residents. The Economic Society looks upon them with a partial eye, and before allowing them to depart, will furnish the necessary aid to put up a co-operative factory at Beaver Falls. It is understood that within ten days Hubbard, Bakewell & Co., will lay a proposition before the men, giving them the choice of working at a reduction or of buying the factory. With the men that point has come when they can no longer remain idle, but must work.

The Sibley Mills, Augusta, Ga., are resetting four boilers with the Jarvis furnace. This makes the third mill in Augusta using Jarvis boiler setting. The others are the Riverside mill and John M. King mill.

Morgan, Williams & Co., Alliance, Ohio, builders of steam hammers, have been temporarily embarrassed by the failure of the Union Iron and Steel Co., of Chicago. The firm have several months' orders ahead and will probably pay every dollar of indebtedness.

It is expected that the erection of the building for the Birmingham (Ala.) Cotton factory Company will be commenced very shortly. The company is fully organized, and the capital, $50,000, subscribed The machinery will be made at one of the best machine shops in the Eastern States.

The Lowell Machine Shop, at Lowell, Mass., is now filled with new machinery, being largely made for Southern manufacturing establishments. The works are sufficiently capacious to give employment to two thousand hands. New machinery is being rapidly put in place in the recently erected extension, so as to be ready as soon as possible. Large orders have compelled the enlargement of the shops.

The Universal Coal Saver and Fuel Economizer is a powdered substance being introduced by F. E. McAllister, 31 Fulton street, New York. It is dissolved in water and the mixture sprinkled over the coal or other fuel. In a circular sent out by Mr. McAllister, we notice some very positive testimonials from parties who use it. One party who used it in a cupola for melting iron says: "It kills the sulphur and prevents the iron from getting hard."

Machinists' and Engineers' Supplies.

NEW YORK, Feb. 22, 1883.

Trade is fair for the season, notwithstanding the flurry in the iron trade, caused by recent large failures. Business in the West seems to be more depressed than in the East. Orders from that section of the country are not very brisk just now.

James D. Foot, 101 Chambers street, New York, has just issued a new illustrated price list of drill and lathe chucks, taps, dies, reamers and screw plates.

Manning, Maxwell & Moore, 111 Liberty street, New York, have just secured the services of Alfred Brotherhood, formerly with Cooke & Beggs, of this city. Mr. Brotherhood, who is well known in mechanical circles, will have charge of the machine tool and engineering department of that establishment.

Cooke & Co., machinists' supplies, 12 Cortlandt street, New York, will move May 1 to No. 22 same street.

Iron and Metal Review.

There is a light demand for Pig Iron, and stocks are accumulating at furnaces. The condition of trade is not assuring, and prices are tending downwards. Recent heavy failures of iron manufacturers have still further influenced the market unfavorably.

No. 1, Foundry is selling at $24.50 to $25, No. 2 at $22 50 to $23, and Grey Forge, at furnace, at $19 to $19.50. There is very little business reported in the latter grade.

Scotch Pig is also very dull and the market in buyer's favor. Eglinton is quoted at $21 to $21.50; Coltness, $24.50 to $25; Glengarnock, $22 to $22.50, and Gartsherrie, $24 to $24.50.

Selected No. 1 Wrought Iron Scrap from yard, sells at $27.

Steel Rails are still quoted at $38 at works, or $40 delivered.

The market for Old Rails is dull at $28 for Double Heads, and $25 to $25.50 for Tees.

Boiler tubes are selling at 55 per cent. discount from list.

Bar Iron, from store, sells on a basis of 2.3c. to 2.4c. for refined.

Copper continues dull at 17¾c. to 18c.

Banca Tin, 22c.; Straits and Malacca, 21¼c. to 21¼c.; Billiton and Australian, 21¼c.; English Lamb and Flag, also English Refined, 21¾c.; Spelter, Common Domestic, 4.65c. to 4¾c.; Refined, 8c. to 8¾c; Silesian, 5c. to 5¼c.; Lead, 4¼c. to 4.60c.; Refined, 4.60; Antimony, Hallett's, 10⅞c. to 10¼c.; Cookson's, 11c. to 11¼c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

Wanted—A competent salesman for a well known first-class steam engine. Address, with reference, B., this office.

Wanted—contractor to run a well equipped machine works, in the manufacture of lathes. Address, Johnson, 212 E. Pearl St., Cincinnati, Ohio.

A mechanical engineer, now superintendent, desires a position as draughtsman, superintendent or manager. Address, M., AMERICAN MACHINIST office.

Wanted—A competent foreman to take charge of general machinery foundry; must have good reference. Address, Castings, care AMERICAN MACHINIST.

Wanted—Situation by a practical foundryman as foreman. Has had long experience in all branches, and in handling men. Address, Foundryman, this office.

Machinists wanted—Two lathe hands, one planer hand and machinery moulder. Strictly first-class, none other need apply. Steady employment. Good wages. McEwen Bros., Wellsville, N. Y.

Wanted—10 to 15 first-class machinery moulders, *non-union*; steady employment given. Wages $2.50 to $3.00 per day. Keystone Iron Works Co., Kansas City, Mo.

Wanted—Situation as foreman blacksmith of a forging shop; 28 years' experience, or would like a job on tools and steel work; no objections to going West. Address, A., care W. B. Bancroft, Enfield, Conn.

Wanted—Situation as foundry foreman; over twenty years' experience, ten as foreman; accustomed to all kinds of work; loam, dry and green sand, heavy and light core making, melting, &c. Address, Manager, AMERICAN MACHINIST.

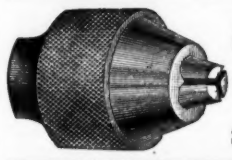
Wanted—Situation by a draughtsman with three years' practical and five years' office experience (technical education besides), competent to assist in all departments of a machine shop. Address, Active, BOX 3, AMERICAN MACHINIST.

12-inch swing screw cutting foot lathe, all feeds; finest made. W. E Lewis, Cleveland, O.

FOR SALE.

Small Machine Shop, 2 years old, at two-third cost. Has Planer, Radial Drill Press, 2 Lathes, Tools, Forge, &c. Used to build 6 H. P. to 30 H. P. Steam Engines. Owners are not mechanics. For Shop or Machinery, apply to

W. J. HOYT, Columbia, Pa.



Almond Drill Chuck

Sold at all Machinists Supply Stores.

T. R. ALMOND,
84 Pearl St., Brooklyn, N.Y

A Great Economic Discovery.

The Universal Coal Saver & Gas Consumer.

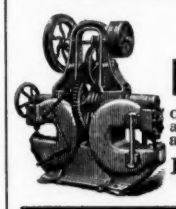
This preparation when applied saves 25 per cent. of the Coal.

Write for particulars,

F. E. McALLISTER, Sole Ag't,
31 Fulton St., New York.

HOLROYD & CO., Waterford, N. Y.
Manufacturers of STOCKS and DIES

For MACHINISTS, BLACKSMITHS & GAS FITTERS



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COMBINED
Punch and Shears

of beautiful design, of great strength and capacity, and thoroughly reliable, address

Lambertville Iron Works,
LAMBERTVILLE, N. J.

T. NEW'S PREPARED
ROOFING.

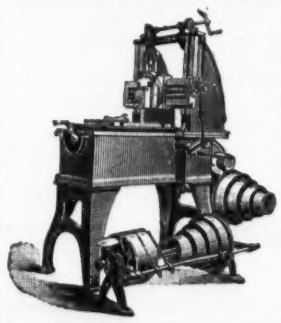
For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.

Steam & Drop Pile Drivers.

Skinner's Patent Steam Pile Hammer, automatic; very effective; simple and durable, with recent improvements.

VULCAN IRON WORKS,
CHICAGO, ILLINOIS.

IMPROVED CRANK PLANER



Planes 16 inches high and wide, and has 12 inch stroke. It has power, cross and angular down feed as shown in cut, or cross feed only, if desired. Also, quick return motion and screw running whole length under bed. It is self-oiling in its ways.

R. A. BELDEN & CO.

Danbury, Conn.

COOKE & CO., DEALER IN

Machinery & Supplies,
12 CORTLANDT ST.,
NEW YORK.

AGENTS FOR THE
Greenfield Vertical Engines
2½ to 30 Horse Power.

Unequalled in workmanship and quality of material. Prices lower than any other first-class engine.

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SUPPLIES
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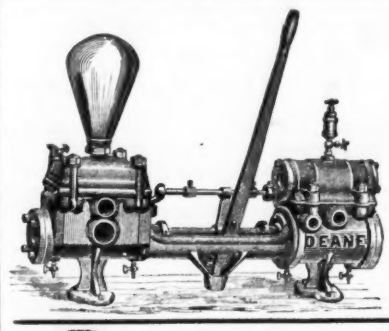
Please send for circular and state that you saw the advertisement in this paper.



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Steam Pumps for Every Service.

Send for New Illustrated Catalogue.

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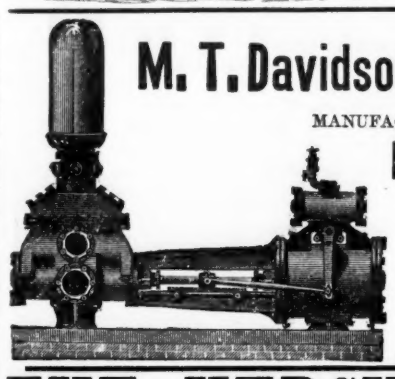
HOLYOKE, MASS.
92 & 94 Liberty St., NEW YORK. 54 Oliver St., BOSTON. 226 & 228 Lake St., CHICAGO.



THE
M. T. Davidson Improved Steam Pump,
MANUFACTURED BY
Davidson Steam Pump Co.,
OFFICE & WORKS:
41 to 47 KEAP STREET, BROOKLIN, N. Y.

Warranted the Best Pump made for all Situations.
KELLY & LUDWIG, Agents,
49 & 51 North 7th St., Philadelphia.

THE HERCULES TURBINE

Gives more power for the same size, also better average results from full to one-half gate than any other water wheel ever made. It is moderate in cost, compact in form, and not liable to get out of order.

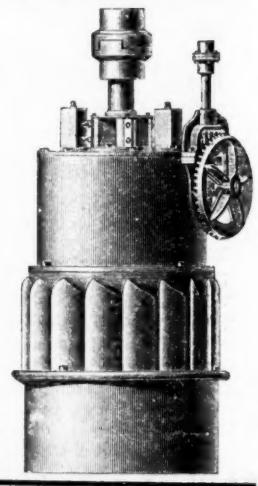
—BUILT BY—

THE HOLYOKE MACHINE CO.

SHOPS AT

Holyoke and Worcester, Mass.

Send for Catalogue, Circulars and Price List to either of the above places.



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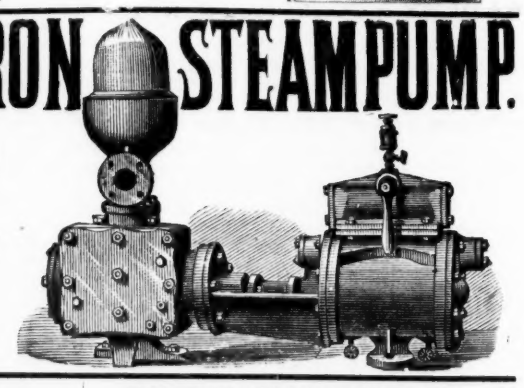
Is the Standard of Excellence
AT HOME AND ABROAD.
THE A. S. CAMERON
STEAM PUMP WORKS,
Foot of East 23d Street, New York.



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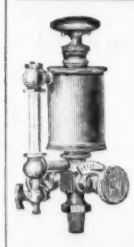
Boiler Coverings, Millboard, Roofing, Building Felt, Liquid Paints, Etc.
DESCRIPTIVE PRICE LIST AND SAMPLES SENT FREE.
H. W. JOHNS MFG. CO., 87 Maiden Lane, N. Y.



The Cheapest. The Simplest Made. A perfect Indicator at all Times. Nothing to wear out. Only Two Valves. Feeds any lubricant from suet to thinnest oil. Under perfect control of Engineer; it can't control him. Saves Oil, Coal, and wear and tear.

A. P. & F. S. GROVES,
Sole Proprietors,
28 South Delaware Avenue, Philadelphia.
AGENTS WANTED.

BETTS MACHINE CO.,
Machine Tool Builders,
WILMINGTON, DEL.

On Hand for Immediate Delivery.
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2½ in. Cutting-off Machine.
40 in. Radial Drills.
36 in Lathes, 20¼ and 22½ ft. Shears.
Axle Lathe.
24 in. x 24 in. Planers, to plane 6 ft. long.
36 in. x 36 in. " " 9, 11, 13 ft. long.

Second-hand—a Bargain.

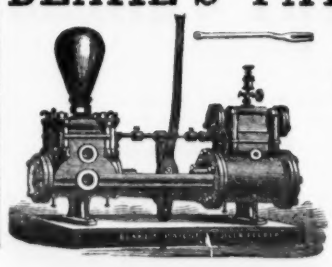
32 in. x 32 in. Planer, to plane 9 ft. long.
36 in. x 36 in. " " 9 "

The above were made by us, have been in use but a short time, and only in our own works. They are in first-class condition.

Almost Completed.

48 in. Radial Drills.
Hydrostatic Wheel Press, for 36 in. wheels.
Horizontal Boring and Drilling Machines, No. 2.

BLAKE'S PATENT STEAM PUMPS.



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Adapted to Every Situation.

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NICHOLSON FILE CO.,

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

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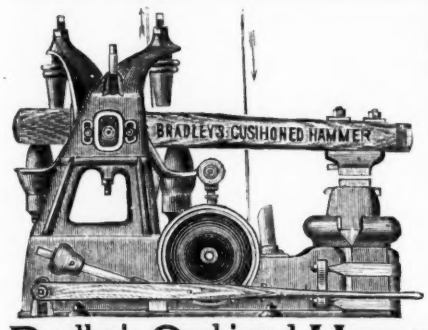

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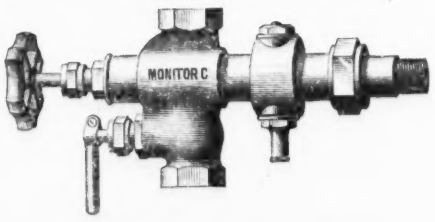

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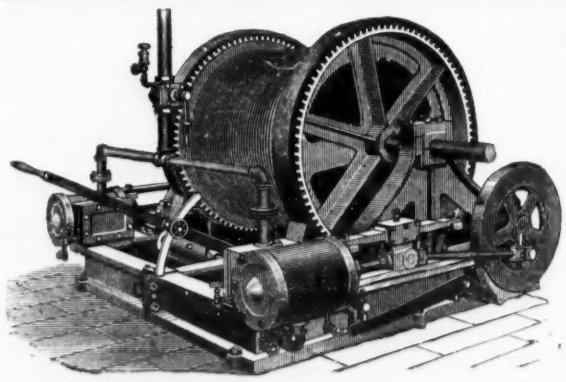

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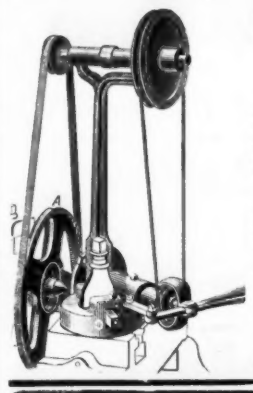

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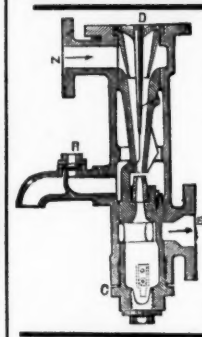

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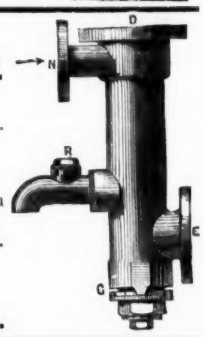

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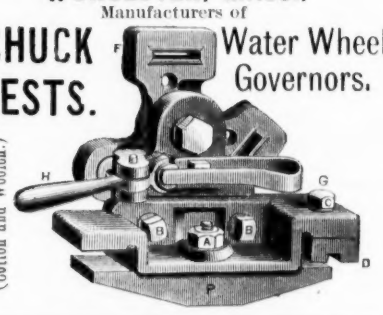

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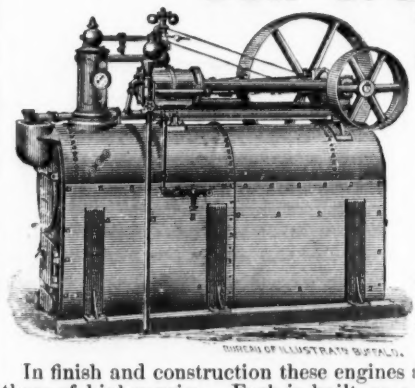

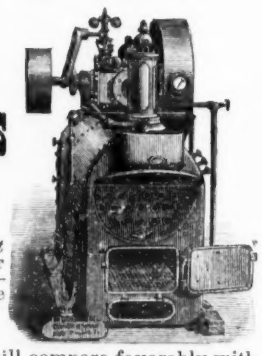

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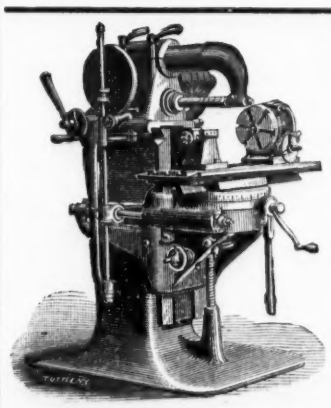

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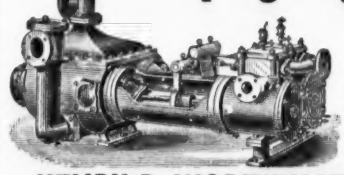

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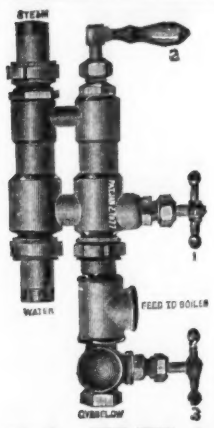

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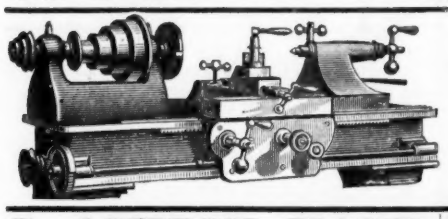

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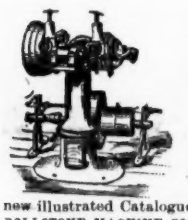

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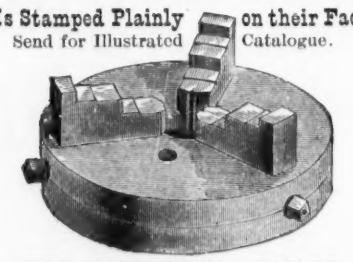

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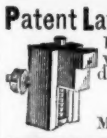

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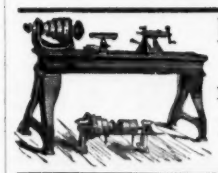

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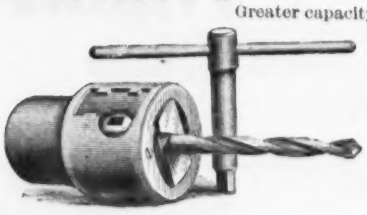

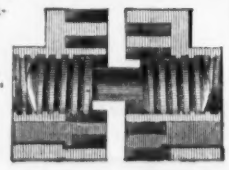

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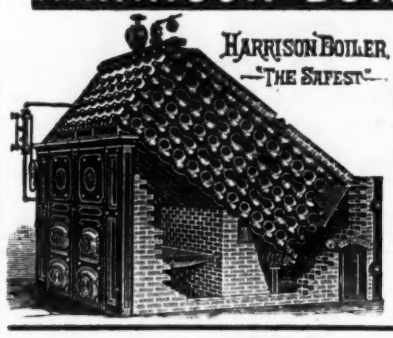

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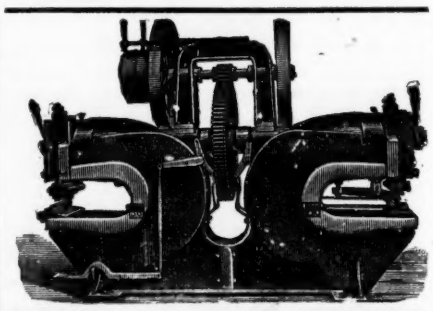

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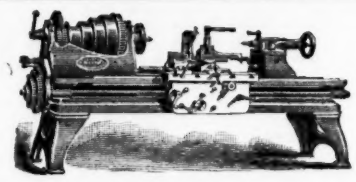

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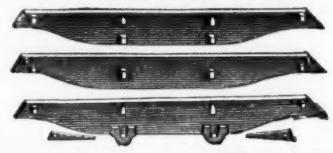

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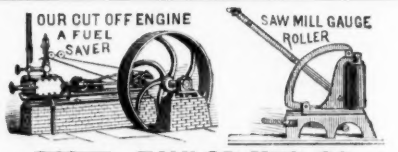

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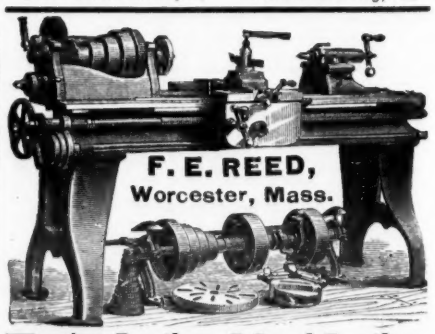

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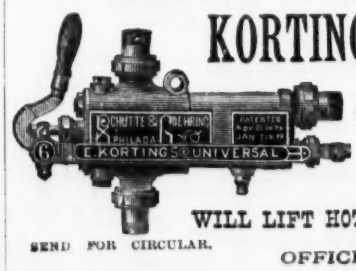

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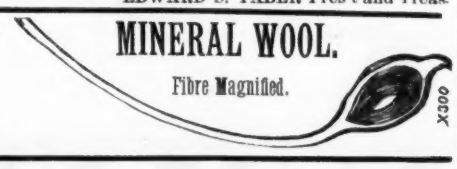

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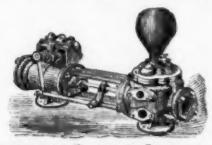

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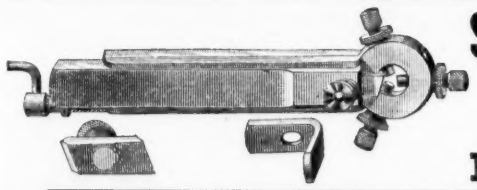

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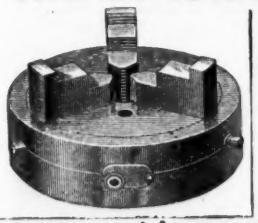

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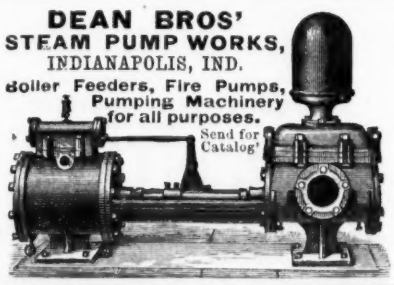

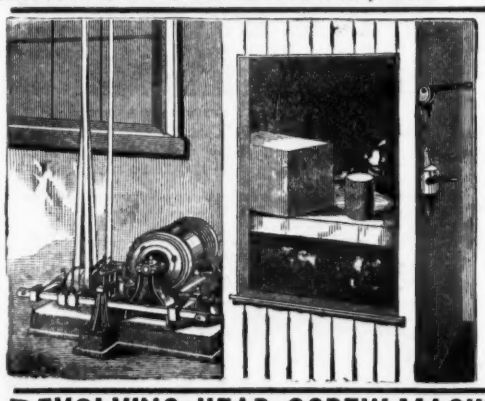

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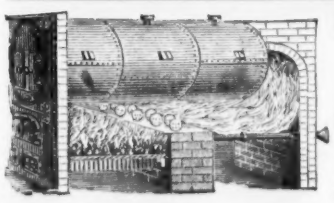

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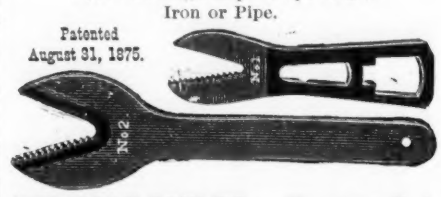

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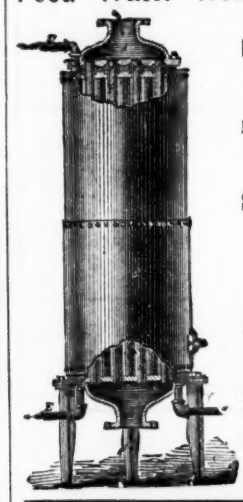

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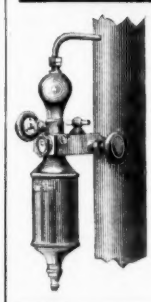

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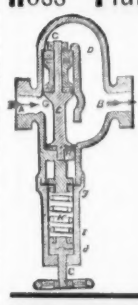

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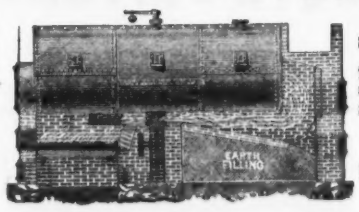

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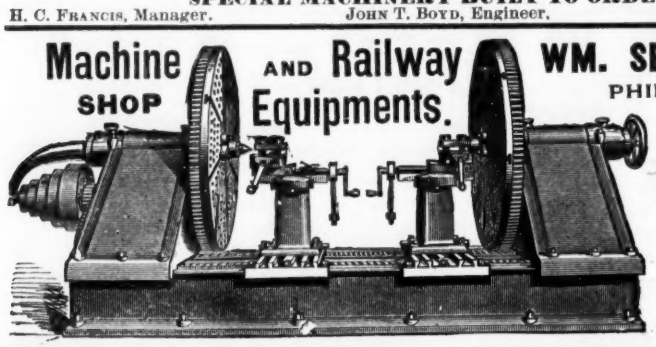

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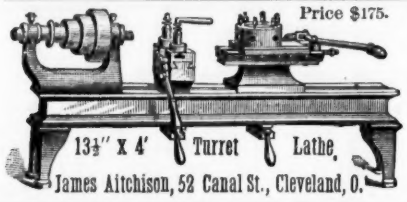

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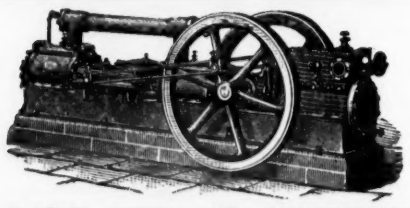

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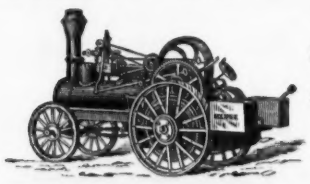

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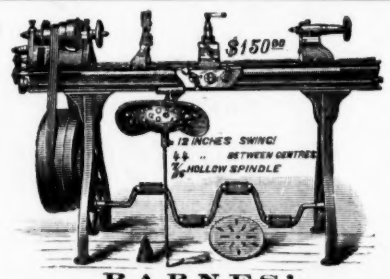

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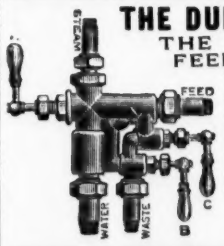

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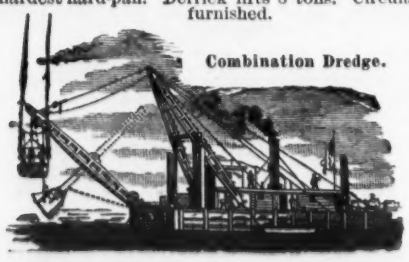

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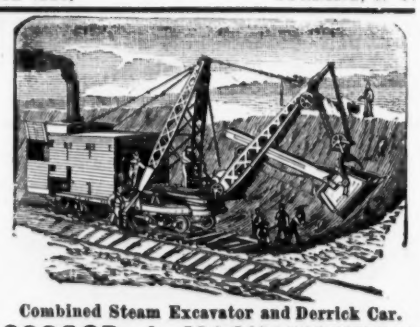

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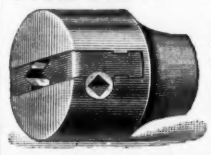

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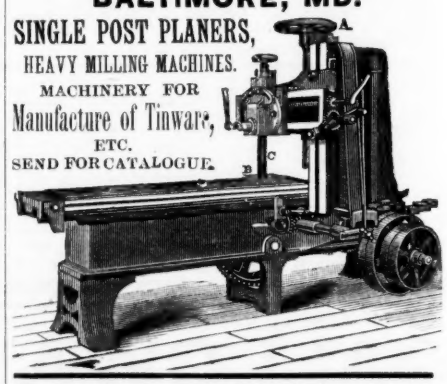

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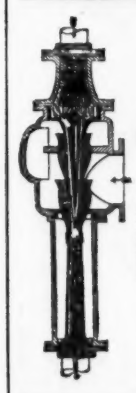

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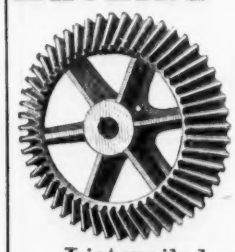

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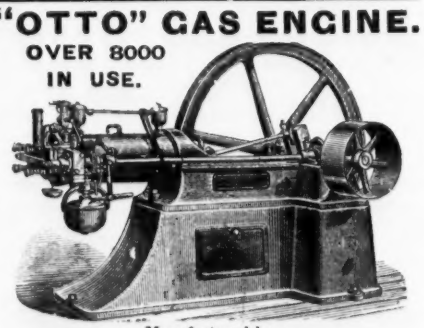

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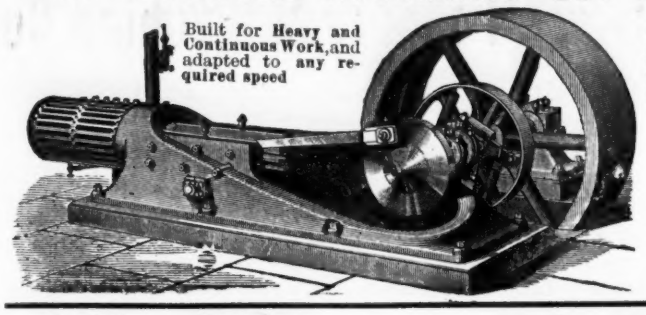

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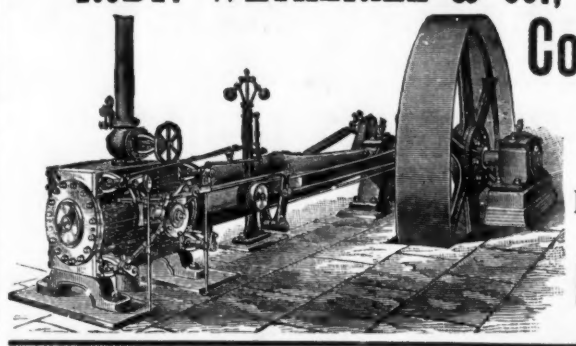

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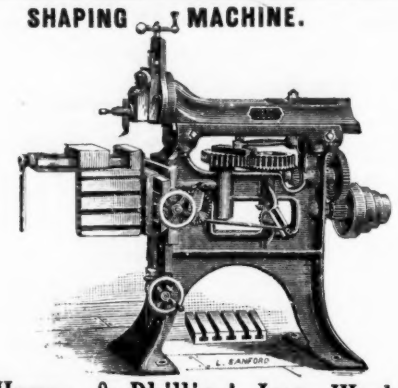

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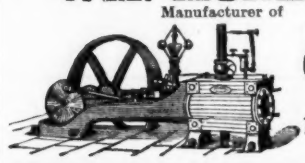

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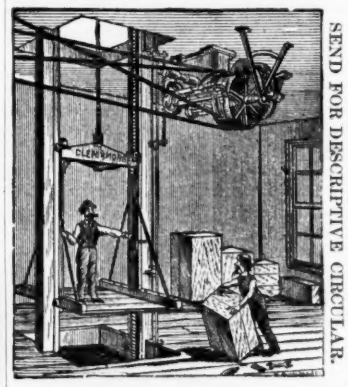

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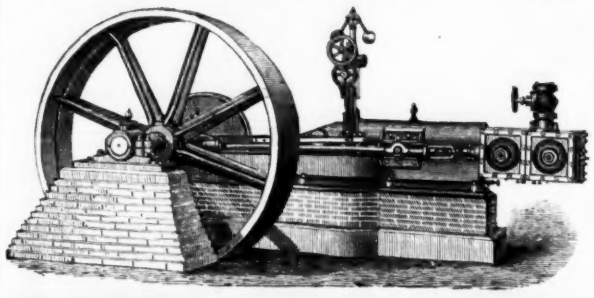

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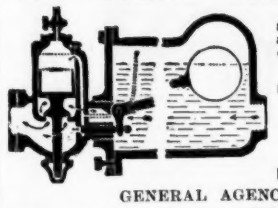

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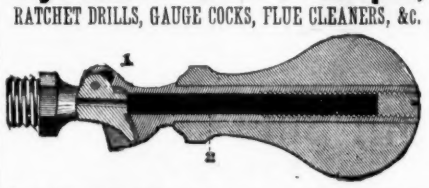

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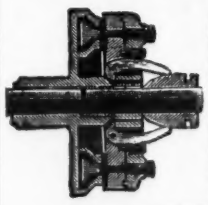

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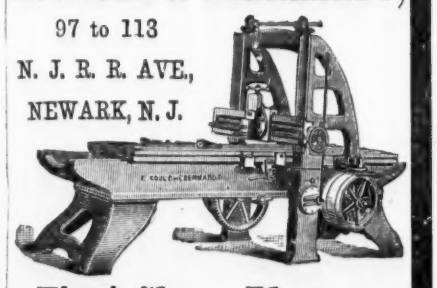

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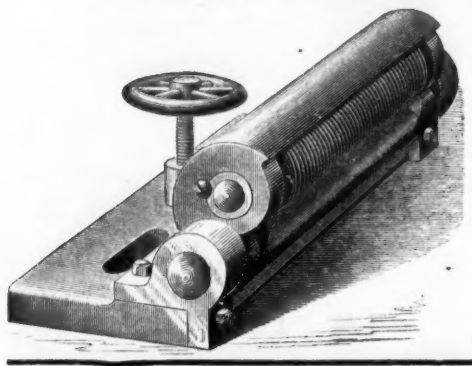

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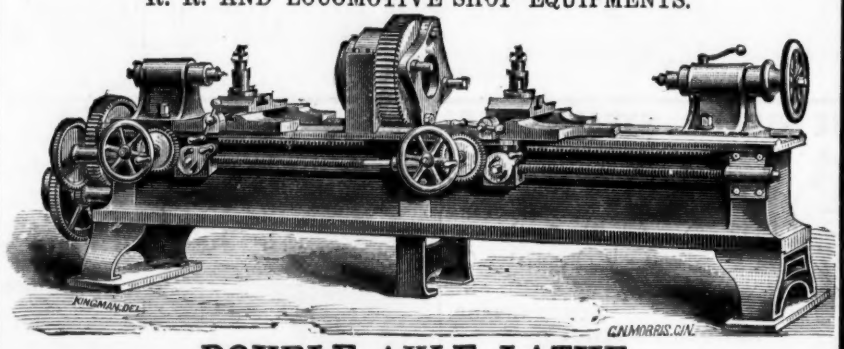

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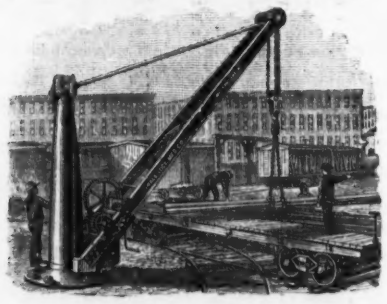

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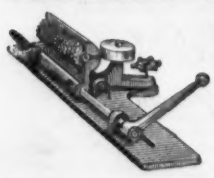

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